Registered No. 182]

THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.



VOL. VIII.] CALCUTTA :—MONDAY, JANUARY 1, 1883. [No. 1. No. 224 / 1B

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Registered No. 182.]

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VOL. VIII.] CALCUTTA :—MONDAY, JANUARY 1, 1883. [No. 1.

NOTICE.*

SUBSCRIBERS to the STATESMAN, FRIEND OF INDIA, *and* INDIAN AGRICULTURIST *are informed that arrangements have now been made by which these journals will for the future be published under the general superintendence of the undersigned.*

All communications concerning the general business of the STATESMAN AND FRIEND OF INDIA *Office, Advertisements, and Subscriptions to the* daily STATESMAN AND FRIEND OF INDIA, weekly FRIEND OF INDIA AND STATESMAN,*and* INDIAN AGRICULTURIST, *should be addressed to the MANAGER.*

All communications regarding literary matter should be addressed to the EDITOR *of the paper for which it is intended.*

WILLIAM RIACH.

June 13th, 1881.

CONTENTS:

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGMENTS.

A HAND-BOOK of Common Salt, by James J. L. Ratton, M.D., M.C., Surgeon Major, Madras Army, second edition, revised and enlarged. Madras, Higginbotham & Co. : London, W. H Allen & Co.

A MANUAL of the Land Revenue Systems and Land Tenures of British India. By B. H. Baden-Powell of the Bengal Civil Service, Calcutta. Office of the Superintendent of Government Printing, 1882.

REPORT on the Experimental Farms in the Hyderabad and Khandesh Collectorates of the Bombay Presidency for the year 1881-2.

ELEMENTS of Sylviculture : a short treatise on the scientific cultivation of the Oak, and other hard wood trees. By the late G. Bagneris, Inspector of Forests, Professor at the Forest School of Nancy. Translated from the French (2nd Edition) by G. G. Fernandez and A. Smythies, B.A., Indian Forest Service. London : William Rider & Son, 14, Bartholomew-close, 1882.

THE Mongoose on Sugar Estates in the West Indies. By D. Morris, M.A., F.G.S., Director of Public Gardens and Plantations, Jamaica. G. Henderson & Co., Jamaica.

RECORDS of the Geological Survey of India. Vol. XV, Part 4.

CORRESPONDENCE.

CAWNPORE EXPERIMENTAL FARM.

TO THE EDITOR.

SIR,—Will you permit me to offer a few remarks on the scathing strictures passed by Mr. O. L. Bryce *in re* Mr. Fuller's experiments at Cawnpore ?

I must first state I am not an agricultural analytical chemist, but an amateur, and secondly, that I have never met Mr. Fuller ; he comes from the N.-W.P., whereas I hail from another part of India, so that you can acquit me of having any personal feelings in the controversy.

Mr. Fuller's lips are sealed by official etiquette, but I am not so restricted—

" Which is why I remark
" And I own it with pain—

That there is nothing in Mr. Fuller's report to show the operations were conducted with want of care ; moreover, I fail to see that any analysis of either farmyard manure, or the superphosphate employed, could have been productive of any real good. Any chemist, or in fact any man who had any theoretical knowledge of *agricultural analytical chemistry*, could, knowing the quality of the ingredients employed, be able to calculate, within very narrow limits, the composition of his superphosphate, *i.e.*—the quantities of calcic sulphate, alkaline salts, calcic phosphate, &c., contained therein. With regard to the state of the manure (farmyard dung) used, if Mr. Fuller did not state whether it was rotted or not, he evidently concluded, as I do, that no man in possession of his senses would, without very good reason, use other than thoroughly decomposed dung.

Again, Mr. Bryce says that Mr. Fuller's experiments have not resulted in any improvement of the staple. This is a sweeping assertion unsupported by specific proof, for the very fact of the pedigree wheat having given such a large yield, in some instances equal to 4 bushels per acre, shows that under Mr. Fuller's management the quality of the grain has improved.

Mr. Bryce again twits Mr. Fuller anent the absence of analysis year by year. This is mere hair-splitting, and it is not unreasonable to suppose that, having increased in productive powers, it may to a slight extent have increased in albumenoids and carbon hydrates, as any other wheat would have done. Surely Mr. Bryce,

as an agricultural analytical chemist, must know that to improve a staple of any kind is a process demanding some years of careful cultivation. Three years is a very limited period, and should the Department of Agriculture succeed in raising a species of wheat to the English or European scale of productiveness in even six years, a great deal will have been done. Nature does not move by "leaps and bounds." American maize, Carolina rice, New Orleans cotton were not brought up to their present standard of excellence in a single decade.

According to Mr. O. L. Bryce, Mr. Fuller's great fault rests in the fact of his not being an *agricultural analytical chemist*, but merely a poor man, an official of considerable ability, who, in addition to having received a liberal education and possessing a natural predilection for agricultural pursuits, brings a mind enlarged by experience in India to assist him in the discharge of his duties. It was no doubt on these grounds that the Government saw fit to transfer him to the Central Provinces. Now the field is clear for Mr. O. L. Bryce. Could you not persuade him, as an agricultural analytical chemist, to offer his valuable services to Sir Alfred Lyall who, in addition to sharing Mr. Bryce's views, would jump at such an offer, and take the first chance of supplying the Department of Agriculture with a long-felt want—*viz.*, an *agricultural analytical chemist?* We should then be no longer shocked at having "experiments badly conducted," "notes negligently made," or the Department of Agriculture brought into discredit, and what is more to the point, those data of the highest importance would be carefully collated:

1. Dates on which seeds were sown.
2. Thermometrical and barometrical changes, direction of wind, &c.
3. Rainfall.
4. Analyses of soil, manure, and irrigation waters.
5. Quantity of straw per plant and bunch.

These essential points would be of course imparted to the outside world, and those who, like myself, are not *analytical agricultural chemists*, but merely amateurs, and as such, are so absurdly weak-minded as to call for impartial criticisms and—

FAIR PLAY.

P. S.—Mr. Bryce has tried to demolish Mr. Fuller: in fact, he has done so to his own satisfaction: but Mr. Bryce may perhaps recollect a tragic episode in the history of Constantinople. Heraclius Exarch of Africa demolished Phocas, the usurper, who had some time previously demolished Maurice, the Venerable Emperor of the East. Before Phocas was finally demolished, in the accents of despair being, we are told, in a very uncomfortable position (in fact by the orders of the avenger of Maurice, hung up by the heels for the inspection of an admiring multitude) he ejaculated: "Would thou have ruled better?" Mr. Fuller will, I know, excuse me for mentioning him in the same breath with the ruffian Phocas, but very probably after this demolition he may feel tempted to ask Mr. Bryce if he also "would have done better" had the Government of the N.-W. Provinces entrusted him with the charge of the Experimental Farm, Cawnpore.

F. P.

CASTOR SEEDS.

TO THE EDITOR.

SIR,—In your issue of November 1, "H. T. T.," writing from the Berars, mentions a large white variety of castor plant, which grows to a height of 15 or 20 feet, and lasts for several years. This variety is unknown to us down here, and I should be much obliged if "H. T. T." would kindly put me in the way of getting a small packet of seeds down to experiment with.

S.

Kurnool, Madras.

NOTE.—We have obtained and forwarded a packet of seeds to our correspondent.—ED., *I. A.*

CASTOR-PLANTING.

TO THE EDITOR.

SIR,—In your issue of the 1st November, "H.T.T.," writing from Berar under the heading of "Castor-Planting," mentions a "buckher." should be greatly obliged if you could obtain for me a description of the "buckher," with, if possible, a sketch. I have failed to get any one that I can trust to make up one, without a full explanation of it; and shall feel very grateful to "H. T. T." if he will help me.

J. O. T.

Bangalore, December 8, 1882.

AN INDIAN TEA PLANTER ON THE TEA ENTERPRISE IN CEYLON.

(To the Editor of the Ceylon Observer.)

DEAR SIR,—I promised to write to you now and again on tea in Ceylon, and ought to have done so before now, but I thought it would be better to wait until I knew more of the climate and land I was writing about, so that I should not lead any one astray. I can now write to you on the subject with more confidence, having spent a year among you, during which time I have seen tea growing from 70ft. above sea-level to over 6,000ft., and I am well satisfied with the growth at all elevations, and I no longer doubt that Ceylon will yet be a great tea-growing country, and the sooner all who are interested in tea put their shoulders to the wheel to send to market teas that will sell at a profit, the better. This can only be done by giving careful attention to the plucking and manufacture.

Ceylon teas are now begun to be known in the market, and we should give our careful attention to the manufacture, so that our teas will get better known. We have all a great deal to learn about the growth and manufacture of tea, and none of us should be too proud to be taught. We can all learn from each other, and should be all willing to assist each other, as all are striving for the same end—that is, to make tea a profitable investment. This can be done; and why make a secret of the fact?

Now that our old love, coffee, has forsaken us, and that tea can be grown in the old fields among the coffee, why not plant tea among the coffee, but leave our old love to shelter tea, and should our old love give us a good crop, cut down the tea within six inches of the ground, which will only improve the new love, and make her flush and blush better than ever?

I am glad to see that Ceylon teas are improving, and I hope that they will continue to improve, although up to the present time there is some awful rubbish shipped from Ceylon, from some of the greatest tea growers in the island—men that should ere this know what good tea is and how it ought to be made, but still they will continue to ship rubbish to the market: in some cases they are ashamed to put the plantation mark on the chests. If they send tea at all to market, they surely should put the plantation marks on the chests, and, if any of us don't know how to make good tea, why should we not acknowledge the fact, and be taught by some one that may know more than we do ourselves on the subject? We can never be too old to learn. I would advise all the Ceylon tea-planters to exchange samples with each other and to visit each other; in fact, I would advise tea proprietors to give their superintendents 15 days' leave each year to go round and visit other estates. If they should see nothing to copy, they may see a lot to avoid; the mere fact of exchanging ideas with each other does a lot of good.

I have no longer any doubt about the profitable growth of tea in Ceylon, and I am sure that it can be profitably grown from 20 feet above sea-level to 7,000 feet. The flavour of the high-grown tea will make up for the shorter yield that one would get at a high elevation.

I consider with careful management that tea could be worked up to 400lb. per acre in the highest elevation in Ceylon, and in some districts in the low country I would not be at all surprised to see an average of 700lb. per acre reached, and what I mean is not 400 and 700lb. of rubbish, but of good tea that should average 1*s.* 5*d.* per lb. I could mention several estates that will turn out more in three months this year than they made in twelve last year, and all among that so-called poor soil of Avisawella and Ruanwella, the richest tea soil in the island which will yet be the great tea districts of Ceylon.

I am glad to say a lot of land is now taken up for tea in the low country, which will increase the value of the oldest pioneers of the district's estates, who well deserve to be rewarded for going into a district that was thought to be feverish and deadly. Had the men that I am now thinking about gone in for tea in the way they went in for coffee, how different would their banking account have been to-day.

I understand that some enterprising proprietors are not going to content themselves with growing tea and cocoa only, but they are going to start a daily steamer, which will do a lot to open out the districts, and ought to pay the shareholders well.

Wishing good luck to the Kelaniganga Steam Navigation Company—

CHA.

AGRICULTURE IN INDIA.

(To the Editor of the Times of India.)

SIR,—I have read with interest the account, written by the Official Director of the Department of Agriculture and Commerce, N.-W. P. and Oudh, of the various experiments which he has made. There are some of which he records the results, that might have been taken for granted, from the general applicability of the old maxim that the more you work land the better you make it. His report seems as if he meant synthetically to construct agriculture in India, instead of applying the common principles that guide the best agriculturists in England, and from them eliminating the inapplicable details for such a climate and country as India. His report, in the equivocal language of the certificates granted by my respected professor of Greek, does great credit to his talents and industry, vouching for neither the one nor the other. Winter ploughing at home is considered much more valuable than spring ploughing, and winter manuring the best. Chemically speaking, the soil and manure get oxidised and disintegrated, and therefore more ready to take part in those chemical operations which result in the growth of plants. This is the result of his experiment when he has invested the soil two months prior to sowing. I notice his inversion is limited to six inches: his is a safe depth, but let him beware of following up his advantage too eagerly. Many a farmer has been ruined by falling in love with deep ploughing; he has raised his subsoil to the surface of the soil, and put himself in the position of the reclaimer of waste land, all the while he was paying rental for the best arable. Another old and time-honoured maxim is, "Don't work your land (while) wet." When you do so, you can easily understand that you are more likely to produce bricks than pulverised soil, and the return will correspond to the crops that could be expected off these varieties of soil.

The one great element that is wanting in Indian soils, and which is not supplied to them by manure as applied by natives, is nitrogen. Odours are to some degree nutrient, and in India where everything smells but the flowers, the deficient nitrogen of this soil may be supplied by the atmosphere. But here we have another example of misrule by the English in India: they are actually by sanitary measures impoverishing the air, and have not been able to induce the population to correspondingly enrich the soil. It strikes me that the Officiating Director, &c., is not proceeding in the way most calculated to impress them with the benefits of nitrification. The 77 per cent of nitrogen free in the air is inert and quite unfitted for purposes of vegetation; only when the nitrogen is in a nascent state, is it in the chemical condition, which permits of its combining with other elements. I will explain it crudely thus. For all practical purposes ammonia (N H 3) the ultimate resultant of manures solid or liquid, is the condition which we wish to reduce these to, so that by its decomposition nutritive material may be provided for plants. Chemically the operation proceeds thus, camel's dung, when treated yields sal-ammoniac; (N H, 4 Cl.), and when to this you add quicklime, you produce ammonia water and calcium chloride, thus Ca O + 2 N H 4 Cl.=Ca Cl 2 + 2 N H, 3 + H 2 O, and what can be done quickly by means of heat in the laboratory, can be accomplished as effectually, though more slowly, by the sun's rays. To give another example: When you wish to make nitrate of potash, you expose animal's matter (containing nitrogen) in heaps, together with wood ashes (*i e.* potash salts), and lime to the action of air: the organic matter gradually undergoes oxidation, nitric acid being formed, which first unites with the lime and then with the potash, to form nitrate of potash. What will be noted in all these chemical processes is that lime is 'quick,' 'living,' or in chemical sense nascent and ready for combination, and by its chemical power it acts as the key to open all the stores of nitrogen which may be presented to it. The Officiating Director, &c., has evidently heard that lime is a good thing, and that gypsum is the sulphate of lime, and that therefore it must be a good thing. But gypsum is a stable compound, and as inert for chemical combining purposes as clay or stone. He himself shows that it increases his outturn most markedly. Gypsum when moderately heated loses its water, and becomes that well known substance, plaster of Paris, which we all know becomes, on again being moistened, a hard cast. If he goes on with this, the Officiating Director, &c., may eventually be able to supply the British public with a very correct plaster cast of an Indian landscape, and the authorities at the Zoo might be induced to lend the tigers to make it life-like.—Yours, &c.,

Berar, November — T. HUME.

BEE CULTURE.

(To the Editor of the Madras Mail.)

SIR,—With reference to the article on "Bee Culture" in India in your issue of the 27th instant, allow me to state that for years I have been interested in the subject, and several times succeeded in partly domesticating them for months; but the difficulties I had to contend with were great. It is so difficult to get the natives to attend to instructions without constant supervision, and from various causes I was unable at the time to give the subject my personal attention, and they resulted in eventual failure. There are three kinds of bees common to these hills, One of them is identical with the European species, the *Apis mellifica.* To clear up doubts, some two or three years ago I sent specimens to F. Moore, Esq., of the South Kensington Museum, and that gentleman was good enough to identify them as the *Apis mellifica.*

Not long ago a notice was in your paper calling attention to the subject, and stating that some *savants* in Germany had written to the German Consul at Madras for information about bees, and more especially about the *Apis dorsata.* Within a day or two after seeing this notice, I collected specimens of the three kinds of bees found here, and sent them to the Imperial German Consul, Albert Gerdes, Esq., at Madras, with the request that he would kindly submit these specimens to his friends in Germany for identification, and should they care to have any of them, I should be happy to collect and send them, on condition that they send out two cages, and that I would fill one, and send it to it to them, and the other cage I purpose keeping for myself, with a view to carry on further experiments here; and should his friends wish to know anything of me, I referred them to Dr. Jagor, of Blumeshoff, Berlin; but I regret to say that Mr. Consul Gerdes has not had the courtesy to acknowledge the receipt of my letter, or the specimens as yet! I may further state I have been in treaty with Messrs. Neighbour and Co., through my son-in-law in England, to get out a beehive, with a swarm of bees, and that they had arranged to send me out their "*Kilburn Collateral Frame Hive,*" but unfortunately some friends who were coming out, and who were to have taken charge of the hive, had to postpone their departure indefinitely on account of ill-health. Thus the opportunity was lost of sending out the hive. Advice received the mail before last states that Neighbour and Co. were arranging with the agents of the British I. S. N. Company to send it out by one of their steamers, and I hope to receive it before long. Honey is plentiful during the season up here; the collection is contracted for by the Mullialies, and sold at 5 annas a quart bottle, but at times we have to pay eight annas the bottle. The honey thus brought round for sale is generally very pure; it is liquid, viscid but translucent, and it has a very sweet taste. If kept for a time the honey becomes thick, white, and granular in texture.

JOHN SHORTT.

The Indian Agriculturist.

CALCUTTA, JANUARY 1, 1883.

CAWNPORE FARM EXPERIMENTS, 1881-82.

No. I.

THE Cawnpore Farm experiments for 1881-82 are officially held to establish that "the main problem of practical agriculture in India is to supply *nitrogen* in the form of a cheap manure." It is nitrogen alone that is deficient in Indian soil. To this declaration is added another (*vide* N.-W.P. *Government Gazette*, 9th September 1882) that "the great increase in produce which results from early ploughing is almost certainly due to the amount of nitrogen in the form of ammonia, which it enables the loosened soil to absorb from the rain, and, probably, from the air as well." The first is an original—a very original—postulate as respects India; the second is—well, the unconscious reproduction of a familiar axiom laid down by Liebig some 30 years ago, and endorsed by all agricultural authorities. But possibly none of these are represented in the Cawnpore Farm library, and the fact in question has doubtless been evolved from the depths of the inner official consciousness. It is satisfactory, however, to have this additional testimony—although needless—to the worth of a long established

deduction in favour of the atmosphere and rain being the sources of nitrogen.

The Cawnpore Farm experiments are in their infancy, and must pass through the initial stages to adultism with the usual ordeals of measles, coughs, and convulsions. About forty or more years ago there was a craze among European farmers about *nitrogenous* manures. It died away when their true value was known : it will disappear at Cawnpore under similar enlightenment. Comparative experiments have everywhere proved that the use of any one fertiliser, whether nitrogen in any of its forms, or lime, potash, phosphoric acid, or others, has always produced conflicting results, indicating, as a disturbing cause, the presence, in different proportions in the fields experimented upon of some available plant-constituent or constituents which the fertiliser assisted the plants in absorbing. It follows that the repeated use of a given fertiliser (as proposed for nitrogen by the Assistant Director of Agriculture) must progressively impoverish the soil of the co-active constituents sooner or later, and reduce the outturn of the crops to nothing. Mr. Fuller's experiments have not embraced this feature of the case, or he would not have overrated nitrogen, essential though it is to plant economy. That *no one plant-constituent is of any value in the soil by itself*, and that several contribute to make up a plant, is a cardinal axiom that should never be lost sight of. The Cawnpore experiments conclusively establish this. An *unmanured* soil (page 288 of the *Government Gazette*, already quoted) yielded 771 lb. of wheat per acre. The same soil, fertilised with nitrate of potash at 240 lb. to the acre, yielded 1,605 lb. Difference in produce—834 lb. Another *unmanured* soil yielded 777 lb. per acre, and when similarly nitrated, produced 1,242 lb., difference in yield 465 lb. If nitrogen is all that Indian soils need, explanation of the disparity in yield of the nitrated plots is necessary. The two *unmanured* soils, it is worthy of note, were in the present instance in identical conditions for experiment. There was a difference of *only 6 lbs. per acre* in their *unmanured* yield ; yet, when nitrated, one field yielded 369 lb. per acre more than the other ! There is but one explanation of this. One field had more assimilable plant-constituents awaiting excitation with activity by nitrogen than the other ; and the conclusion that follows is, that *something besides nitrogen* is needed for Indian soil.

The above illustrates also the wide variations in latent fertility over small areas. The rule holds good everywhere. It is quite to the point to suggest that the above noted difference in yield of 369 lb. per acre, or, for the benefit of those accustomed, to think in Government bigahs, 6½ maunds per bigah is not a maximum difference. The possibilities of experiment might at any time furnish two fields that, in an unmanured condition, would yield a difference, say, of 100 lb. per acre ; but fertilised, whether by nitrate of potash or phosphates or other constituent, the apparently inferior field might yield 1,000 lb. per acre more than the other. The explanation in this case would be just the same as in the Cawnpore experiments. The fertiliser would be assisted through more co-active plant-constituents being present in one field. Our present agricultural knowledge does not extend so far as to determine what combinations take place within the soil, and we cannot tell what the effect will be by the addition of fertilisers, or by combinations of them. We can tell generally only after a crop is raised what the effect has been, but we cannot predict from this the effect on fields elsewhere ; so that, whatever the results with certain fertilisers on certain fields may be, they hold good only for those fields, and only for the occasion in question. In the Cawnpore experiments nitrate of potash was found good for two fields there. The results were true for them only, and for that occasion. Nitrate of potash might have yielded superior or inferior results elsewhere, or even in the two self-same fields on repetition of experiments. What holds good of the nitrate of potash in these cases, is equally true of other fertilisers, or combinations of them. The question then is : In the absence of any knowledge of combinations within the soil, what conceivable purpose is served by experiments, such as those in the Cawnpore Farm, and, for years, elsewhere? Probably, experimenters hope to fluke into some discovery that will prove the key with which the untold agricultural wealth under our feet is to be unlocked.

No one article could be universally used as a fertiliser. The supply could never meet a fraction of the demand. Two hundred and forty pounds of nitrate per acre were used in the Cawnpore experiments. Every 1,000 acres would, therefore, need 240,000 lb. of nitrate annually ! From this simple illustration may be judged the feasibility of supplying, even under the proposed freedom of saltpetre manufacture, the requirements of a single district in the North-West Provinces and Oudh. We may, in fact, dismiss the notion. The country is virtually no better for the alleged discovery of the efficacy of nitrate of potash as a fertiliser. Millions of acres must remain without it. What the effect might be of annually saturating the soil with saltpetre is a point that requires careful consideration on behalf of the very agriculturists whose interests are sought to be promoted.

But discussing the Cawnpore experiments on other grounds, a radical defect in the conditions vitiates the results. The area of each plot—*viz.*, one-twelfth acre—was too limited for reliable results. The most conservative settlement officer, afflicted with a craze about State rights, would not attempt the computation of the out-turn per acre over a large area from so small a plot as one-twelfth of an acre. He would never base the Government demand on the produce of one-twelfth of an acre of the most fertile field in a village in order to "vindicate Indian agriculture." An insignificant twelfth of an acre, carefully fertilised and sown with picked seed to the utmost fraction of a square inch, solicitously tended, and irrigated opportunely *no less than four times* during the growth of the crops ! Are these the possible conditions of Indian agriculture, whether by wells or canals ? If this is the way the Department of Agriculture intends to develop the potentialities of the soil, it will have to wait for a teeming population, minute sub-division of land, a saltpetre factory in every village, and an inexhaustible water-supply.

II.

THE poverty of a given soil is simply a question of degree. It might be rich enough for the production of an abundant crop of some sort, yet poor in comparison with other soils. This is the position of the Cawnpore soil, which the farm authorities declare is "generally poor and nowhere of *exceptional* fertility." Yet on an "*unmanured* plot which had been watered only twice, the crop (wheat) reached the very high outturn of over 44 *bushels per acre !*"—(*N.-W. P. Gazette*, September 9, page 284,—very little justification for denouncing such a soil. But the outturn in the given instances and others less remarkable is attributed to the use "of a soil-inverting plough." While admitting the advantages of such a plough under the supplementing conditions of a needful supply of fertilising matter, it is a reasonable assumption that the Cawnpore farm has, during various experiments and operations over past years, received manures of sorts directly and indirectly to an extent which is impossible to ordinary Indian agriculture. As no crop exhausts the manure specially supplied for it, some is still left in the soil. It is carried down or diffused beyond the reach of the roots. This aspect of the question has been often discussed, and it is estimated that from about one-third to a half only of such manure is removed by a crop. The spaces between the *roots* of one plant and those of the surrounding plants represent untouched fertility, and the aggregate of such spaces is from one-half to two-thirds of the total area covered by a crop, according to character. Part or all of the remaining manure is doubtless removed by subsequent crops ; but considering that every portion of manure is not immediately assimilable, a residue of fertilisers is always more or less present in the soil of experimental farms. Again, some crops will remove more constituents of one sort than others. Unless, therefore, the history of every field or plot in an experimental farm is carefully and accurately kept, it will be difficult to estimate the value of experiments, with specific manures, or with unmanured plots, *i.e.*, plots not manured for experiments. It will have been seen from the previous article that of two plots

in *unmanured* fields in the Cawnpore farm, one yielded 771lbs. and the other 777lbs. of wheat per acre. For all practical purposes the difference of 6lbs. per acre is nothing. Yet in these self same *identically-conditioned* fields, two plots, manured each with 220lbs. of nitrate of potash, one yielded 1,242lbs. of wheat and the other 1,605lbs., or a difference of 363lbs. per acre. There must consequently have been a marked difference in the amount and character of the residue of previous manures in the fields in question, and of the assimilable constituents of the soils themselves (by different rotation of crops) which the nitrate of potash started into activity. As argued before, it is not one constituent, but a combination of constituents, that go to make up a crop (an old established fact), and therefore any results obtained by the use of nitrate of potash alone would not demonstrate the exceptional value of the nitrate, nor justify the deduction that "the main problem of practical agriculture in this country is *how* to apply nitrogen in the form of a cheap manure."

The matter is susceptible of further illustration. The total amount of *nitrogen* removable by a wheat crop of 20 maunds or 1,600lbs. per acre is given (at pages 290 and 292 of the *Government Gazette* aforesaid) at 45lbs. per acre. The amount of nitrogen in 240lbs. of potash is quoted (at page 289) at 12 per cent or 29lbs. But these 240lbs. of nitrate per acre could not all possibly have been directed to the roots of the plants. Diffusion over and within the soil rendered available about half. 14½lbs. of nitrogen then were utilized by each crop. But the field producing 1,242lbs. of wheat or 15½ maunds per acre, removed 35lbs. of nitrogen, and that yielding 1,605lbs. or 20 maunds per acre removed 45lbs. Whence did the excess of 20½lbs. of nitrogen in one case, and 30½lbs. in the other, come? Even if we suppose the whole 29lbs of nitrogen to have been assimilated by the crops—an impossibility—we still have an excess of 6lbs. in one case and 16lbs. in the other to account for. Of course it was furnished by the soil and the air. But why an excess of 6lbs. in the one case and 16lbs. in the other, unless we turn for an explanation to the different latent conditions of the two soils, induced by the unequal residues of previous crops and manures, and by the different states in which dissimilar rotation of crops left the soils to be acted upon by the nitrate of potash.

No reason is given in the farm report for preferentially employing the nitrate in the experiments in question. In fact, these experiments are but counterparts of all others at Cawnpore and elsewhere. Given a manure or fertilising agent, to discover its value is the problem unintelligently sought to be worked out, but which will certainly never be, beyond the point that a fertiliser *must* comprehend one or more *soil*-constituents, or, which is the same thing, one or more plant-constituents. And this can be done without resort to expensive and valueless experiment—namely, by comparative analyses of fertiliser, crop, and soil. To show how little the soil at Cawnpore needed nitrate of potash, analysis at Roorkee (page 290 of *Gazette* aforesaid), showed that it possessed *to a depth of* 9 inches 5,717lbs. of nitric acid, equal to 1,483 lbs. of nitrogen per acre; and potash 16,335lbs. per acre. Nevertheless with this foreknowledge of the wealth in the soil, 240lbs. of nitrate of potash containing 29lbs. of nitrogen were added to the soil. Why was this done when nitrogen enough for 33 crops of 20 maunds each, and potash enough for 600 such crops, was present within a depth of nine inches in the soil? No explanation of the proceeding is to be found in the official report in question, any more than in other like recorded cases for years previous anywhere, whatever the fertiliser used, whether simple or compounded. Justification to a certain extent can, however, be found on some such basis as the following. The Cawnpore soil was analysed to a depth of nine inches. Fertility diminishes downwards, the ratio has not been as yet even approximately determined and systematised under soil classification. The *maximum* fertility of any soil is, however, known to be within the depth of the first three inches. The inversion of the soil by ploughing reduces this upper fertility proportionately to the depth and uniformity of inversion. To get, as far as practicable, the average fertility to the depth of inversion, it is advisable to take portions of soil to such depth, say for every three inches of the section, and after mixing thoroughly to analyse the same. This was done at Cawnpore. The result obtained—namely, 1,483lbs. of nitrogen, and 16,335lbs. of potash per acre—requires to be reduced by two-thirds or by half, according to the root-space occupied in surface and depth by a crop, as before shown. This will give 497½lbs. nitrogen and 5,445lbs. of potash in one case, and 741½lbs. nitrogen and 8,117½lbs. of potash in the other—*within reach of the roots of the crop.* In other words, in one case 11 times as much nitrogen and 200 times as much potash as would be required by a crop of 20 maunds of wheat per acre; in the other 16 times as much nitrogen and 300 times as much potash for the same crop. Therefore, justification still fails for the empirical addition of 240lbs. of nitrate of potash containing 29lbs. of nitrogen. *None was needed*, if any dependence on analysis is to be placed. The fact is that in all experiments the well established fact of years is overlooked—that *the fertility of a soil is represented by the assimilable plant-food it offers.* No rule for determining this has as yet been found, and no effort is made in the direction either. That by adding fertilisers the soil is made more than naturally fruitful has been known for ages in agricultural history. But how much a given soil requires for a given crop and what the constitution of the fertilizer, we are nearly as ignorant of now as in days of yore. That the assimilable constituents of a *soil* will vary in quantity and character *after* a crop and *with* the crop to be raised, is manifest no less than that the quantity of a *fertiliser* and the proportion and character of its constituents should vary with crop too. The determination of these points is essential, as also the constituents of a *fertiliser* that (1) are assimilable within the time needed to benefit a crop, (2) that acting on, or acted on by others in, the *soil* will augment the assimilable constituents needed. It will *then* become possible to estimate the *composition and quantity* of a fertiliser in harmony with (1) a given crop (2) to the ascertained physical condition of the soil reserved for that crop.

Herein lies the future of agriculture. He who resolves these points will unlock the long-hidden potentialities of the soil.

A. P. W.

THE GOVERNMENT OF BENGAL AS A LANDLORD.

BEFORE many days have passed, Mr. Reynolds will introduce the Rent Bill into the Legislative Council of India. The time is most opportune to remind the Lieutenant-Governor that he is himself, on the part of Government, as great a landowner as any private individual in these provinces, even such sacred magnates as the Raja of Burdwan and the Raja of Durbhunga; and to enquire how his predecessors have fulfilled this great trust which affects property of the value of twenty lakhs a year. We know that in England the Government does not require reports on the conduct of landowners, does not lecture or reprove them, and has scarcely interfered with them by legislature; but on its own estates it has shewn an example of moderation as to rents and generosity in improvements. All Crown lands are let on easy terms, and much enterprise has been shewn in draining, fencing, and providing suitable farm buildings. In India the Government has been much more free in its censure upon others, more ready to interfere with the strong hand of the law; so it might be supposed that its own conduct would be even still more above reproach. We might expect to find that in every district the Government estates formed a model of good management, with rents moderately assessed, the best means taken for the security of the tenant, and a provision for improvements so liberal that a marked difference might be observed between Government villages and the surrounding tracts. Such would be the reasonable expectation from the experience of England, and from the language addressed by officials to private owners: what are the facts?

Moderation in the exaction of rent is the first principle of good management, most of the [illegible] merely because they lead to the [illegible] rack-renting. Has Government [illegible] respect to private owners? We see [illegible] no very recondite authority, that officials fixing rent rates are not expected to set an example, but to follow one,

taking the rent rate of private lands in the neighbourhood for a guide in assessment. Provision is made for cases where the private rents may appear too low, and then some other reason is to be sought for enhancement; but nothing is said as to rejecting the standard where the private rents are too high. It follows that, under the rules, Government rent must always be as high as that of private land, and often higher. We notice that, taking the average of all the settlements made last year, the enhancements were about forty per cent. of the original rental. Government settlements are for short periods, say ten years, and if forty per cent. is added at each renewal of the lease the rate will double every twenty-five years, and by mathematical progression increase sixteen-fold in the century. This, it will be admitted, is quick work; the pace is rather rapid for the ordinary ryot of Bengal. To take another test, that of the satisfaction of the tenants. We find that they are very generally combining on Government estates to resist enhancement, and even to make a demonstration, by refusing all rents. Many of the Government ryots of Midnapore have been seen in Calcutta assembled in large bodies to protest against enhancements, which it is admitted were excessive, and in some instances absurd. In Noakhally, the Civil Courts have declared some of the enhancements made by Government positively illegal. These may be isolated cases, but what are we to say to the fact that last year only three-fifths of the current demand was collected on the whole of the Government lands? If short collections in a good year are a symptom of rack-renting, its presence in an alarming form cannot be denied. It is seldom possible to know what proportion the rent bears to the value of the crop, but we have this information as to the largest Government estate recently settled, that of Khoordah, near the Tributary Mehals of Orissa, which it resembles very closely in character. The proportion there is one-fourth. Now one-fourth is the highest proportion which, under the new Bill, can be taken from ryots on the richest lands, near the most populous towns, where competition is closest. How this maximum can be exacted from a primitive people cultivating a half-reclaimed jungle in an inaccessible region, is a puzzle for Mr. Reynolds to explain in his double capacity as member of the Board of Revenue which confirmed the settlement, and the introducer of the Bill in the Indian Council.

As to the protection of tenants at the rents imposed, it is to be noted that the system most inimical to it is that of introducing middlemen, who farm, not the land, but the ryots, taking them over in a body to make money out of them. This is called the *ticcadari* system, and under that name, has been denounced by all officials unanimously. It introduces, they say, men with no interest in the estate, except to screw the last penny out of the tenants during the short period of the ticcadar's lease, men who have made a trade of the art of doing this, and who do not scruple to adopt means such as ruining a recalcitrant ryot by forgery and false charges. Such being the Government view of the *ticcadari* system, we must ask why the system is extensively adopted on Government estates? We suppose that more than half the Government estates are thus farmed out. The rule is to manage such estates directly, where it is not inconvenient to do so, and it is so often inconvenient that the middleman is quite a Government institution.

The great reproach against the Bengal landlord is that he does not improve, or even maintain, the farms on his estates. An English landowner builds the farm-houses, digs the drains, plants the trees and hedges, makes the gates, and hands over the land to the farmer ready for the plough. It is objected to the Bengal zemindar that he does none of these things; that he sits by while the land is converted from primeval jungle into arable fields, sees the occupier raise the farm-houses, cut the undergrowth, break the soil, and dig the wells, and then demands nearly the whole profit. It has even been urged that, being a mere unproductive burden on the land, he may properly be put aside. Now, this description, it must be admitted, applies to Government, as a landlord, without any qualification whatever. Private owners claim to have improved in some places; it can be proved that Government, as owner, never improved. The railways, roads, and canals made have no special reference to Crown-lands, and are executed by Government as ruler of the whole country, not as landlord of certain definite estates. The only provision made for the improvement of these was a fund of five per cent. on the rental. In many districts this has never been drawn, and where touched, it was devoted to education and roads, and not, except in some infinitesimal degree, to improving the estates. The fund has been abolished, and in its place there is to be an allowance of seven and-a-half per cent. on rental, for collection expenses and improvements, the allowance to private persons, for collection only, being ten per cent., and often twenty. It is plain that little or nothing for improvements can come from such a fund. On the majority of Government estates, the landlord contributes nothing, directly or indirectly, to make or maintain or improve, and is as much a mere drag on agriculture as the worst private owner can be.

It will certainly be an awkward position for Mr. Reynolds when he has to appear in the legislature as the champion of the last of tenant-right, reduction of rent, compensation for improvements, and so forth, he being, as the member of the Board of Revenue, in immediate charge of Government estates, the representative of a system of management of which the three catch-words might be, "high rents, middlemen where convenient, and no improvement." He will remind many, of the crab in the fable cautioning its son against walking sideways; of the tipsy preacher at the temperance meeting in *Pickwick*, who accused his audience of being drunk; of the warning of Ophelia to her brother—

> Do not, as some ungracious pastors do,
> Show me the steep and thorny way to heaven,
> Whilst, like a puff'd and reckless libertine,
> Himself the primrose path of dalliance treads,
> And recks not his own rede.

But we hope that he may really be rather like the father in the story-book, who learned morality and religion in teaching them to his son. The position in which the Bengal Government has now placed itself, as the defender of the ryot in the legislature against rack-renting, must, we hope, force it to play the good landlord itself. Already, in many ways, we see signs of the doubts that precede repentance and amendment. Sir Ashley Eden would probably have denied that there was much amiss on Government estates, but Mr. Rivers Thompson seems to admit that there is, and to be preparing for reform.

PETROLEUM IN ASSAM.

We read in a London trade journal that—"Advices just "to hand from New York inform us that the production of petroleum at present is at a figure but little greater "than the demand for it. The rapid decline in the yield "of the producing districts is causing unusual apprehen-"sion in the minds of those in the States who look farther "into the interests of the petroleum trade than the specu-"lative branch of it affords." It would seem from this that the enormous demand made upon the oil deposits for the last quarter of a century are at length beginning to tell, and that the American springs, vast as they have hitherto proved themselves, are by no means inexhaustible; no doubt, were extraction to cease for a time, and thus permit natural distillation to replenish the springs, the supply would become as bountiful as heretofore, but chemical knowledge has not, as yet, enlightened us as to how long the process of distillation requires; and petroleum, like coal and other indigenous deposits, has been regarded in the light of a widow's cruise, fully equal to any demand made, or likely to be made, on it. In the face of the possible falling off in the yield we note that "sales have been enormous, and a considerable rise in price is anticipated." Looking to the numerous uses to which petroleum and its derivatives are put to, and their probable extension, it is time, we think, that the mercantile community should bestir themselves, in view of opening up and developing the springs known to exist all over and beyond the north-east districts of Burmah and Arakan. It is true that the Assam deposit remains practically locked up from the paucity of local labour and inadequate means of carriage, but it is reasonable to suppose that the river steam companies would meet enterprise half-way, and lower their freight so as to admit of the mineral being placed at the site of export with some margin for profit. The rates ruling in London, when the mail left, were 7*d.* per gallon for common to 7½*d.* and 8*d.* for refined, with the prospect of an immediate advance; and though it lies not within our

province to express an opinion as to whether such prices would prove remunerative, we give the information for the benefit of those who might consider the matter of prospecting during the ensuing cold weather. In the event of the supply ceasing, or falling off to an appreciable extent, from America, British India is practically the nearest source of supply, and the comparative slight depths of the springs in the vicinity of our surface coal deposits, coupled with cheap labour, should give the Indian mineral decided advantages. It is not very creditable, we take it, that we should go on importing a daily requisite, when its presence in abundant quantities lies within our own borders. To those who may be under the impression that the assertion of the diminished supply is but a *canard* set afloat by an "ile ring" of speculators, we may mention that the State authorities have for some years past issued repeated warnings, at the instance of competent mineralogical experts, that the springs in America were being drawn upon in a manner incompatible with prudence. Even were the prospect of a profitable export trade not sufficiently clear to admit of large works being undertaken, there can be very little doubt that considerable gain would accrue to any enterprising individual who would undertake to tap the springs in Assam, refining on the spot, for the purpose of meeting the demand in the local markets. The universal avidity with which all classes have taken to the use of kerosine for light and cooking, and the consequent enormous consumption, affords reasonable justification for predicting success for the working of petroleum in a properly organised manner; and now that what was formerly termed "the waste," possesses, under the name of vasiline, profitable commercial value, we have additional inducements for the launching of a new and non-speculative enterprise.

THE WARRORA COLLIERY.

By H. T. T.

A VISIT to the Warrora Colliery will well repay any moderate trouble and expense incurred in it. Situated centrally in the continent of India, and, perhaps with design by the Great Disposer, where raw materials exist in lavish abundance, it is the natural fuel-supplier to a large extent of country, and would, under any other than its present and past management, have fully developed its unrivalled advantages of supply to the perfecting of existing industries and the promotion of many now unformed, and would have yielded returns which would have satisfied the most exacting. For had there been any prospect of a continuous supply of fuel, the iron, richer in its ores than in any other part of the world; the cotton which, for its manufacture, has to travel hundreds and even thousands of miles; the slate quarries, paper, wood, oil, sugar, and spirit material—would have each and all started for themselves local houses of manufacture. After 12 years of working, however, under the present direction, the colliery almost totally failed the other day, and the output of coal has been beyond computation meagre—indeed, so bad that the few cotton presses and two or three spinning mills, with this coal at their very door, and desirous of using it, have to burn dearer wood; and the G. I. P. Railway, its largest customer, is supplied spasmodically and scantily, so much so that it had to arrange till very lately for its local consumption 1,000 miles away, although this colliery is only 45 miles from its line. The great anomaly at Warrora is that very many trucks of wood—grand old tamarind, mohwa, and mango—leave the station daily for the mills in the Central Provinces and the Berars. The basin, collectively designated as the Warrora coal measures, is hardly as insignificant as you have been led to believe. It is in fact of wide extent. Known to extend to Chanda, 30 miles south—for over this tract small masonry pillars mark where borings have found coal; and miles to the south in the Nizam's territory on the line of the proposed Chanda and Hyderabad Railway, the seams discovered point to the presumption that the coal is continuous. Then, at Peacegaon in the Berars, 20 miles in a south-west direction from Warrora, shafts were sunk, machinery imported, and preparations were made by Government to work the coal on a grand scale, but, from some cause or other, the scheme was nipped in the bud, the machinery has become worthless from neglect, houses and stores are in ashes, as well as the prospects and outlay on the undertaking. Between Warrora and Peacegaon coal has been found at Wun and other places, and the river Wurdha flowing in a south-easterly direction, midway through this tract, towards Chanda, has coal cropping up at all places. So, leaving out the mineral found in the Nizam's territory, we have a certain area of at least 600 square miles in the Central Provinces and Berar, with three seams of an average thickness of 12 feet each, within a mean depth of 300 feet, the first two lying beneath only clay and shale, and the third beyond this and a few feet of sandstone. It would have been almost impossible, one would have thought, to have misdirected an undertaking so favored by nature, and with little ingenuity this scheme, with a railway to the pit's mouth, abundance of labor, and untold funds at disposal, would have been projected to undoubted success; and it is difficult to compass the startling and almost incredible fact that stares us into dismay, that the enterprise has hitherto resulted in failure. If ever the acts of man demanded a Royal Commission of enquiry, they do here. For from the extent of public funds involved and meagre results, there can be only one tale revealed—of incompetence, gross fraud, and waste. The administration of the Central Provinces by Mr. Morris has been by no means a success, and for the whirlpool of funds lost in this colliery speculation, he must be held primarily responsible. A ruler after the type of the great Sir Richard, he possesses all that statesman's autocracy and speculative propensities, without that energy which makes personal rule felt to advantage; without that discernment—the gift of even mediocre men—which instinctively spots the right genius and means to carry out the right undertaking; and without that malleability which adapts itself to the altering relations of the state with "interlopers" and their industries. He has, therefore, centred in himself all power, patronage, and authority, even to its widest details, possessing a mind whose every effort has been directed to the discouragement and stamping out of all private enterprise, by involving Government and dissipating its resources in coal, railway-sleeper supply, horse dawk, and even hotel speculations: all having one issue—miserable failure. His revenue administration, instead of having, with inducements, opened out a fertile country, has left in a state of virgin forest almost three parts of the province he rules, and the revenue of his government is nearly stationary, as in the days, many years ago, when he assumed office. The only returns which show a large increase are those derived from abkari and litigation, and organised crime is rampant in his dominions. His sanction and recommendation of the Chutteesgurh Railway on the narrow gauge, simply because the misguided power above him favored it, must ever leave on him the indelible stamp of incompetence, for he very well knew that it would immediately have to be pulled up, because a break of gauge could never be tolerated for a moment on the highway from Calcutta to Europe. Hence, notwithstanding our liberal Viceroy's praise and quoting of him as an advanced Liberal, he still remains a fossilised autocrat, true to the instincts and traditions of the Haileybury set, and his race, happily fast dying out, mark, by way of contrast, what rapid strides a neighbouring province, Berar, has made under Mr. Jones—able, hard-working, honest, and who strives to do his duty by all. The revenue, while Mr. Jones held sway for five years, trebled itself, and the province—a third of the Central Provinces—yields nearly as large a revenue. Waste places have been peopled and opened out with roads, private industries cherished, and the country, a hot-bed till lately of serious crime, quite purged of it. Men reared in the traditions of the Commission, with few exceptions, get so bound up in red tape and routine that, by the time they attain the period when they should govern a province, their ideas are so cramped from circling in limited spheres and appointed grooves, that they are altogether unfit to administer the destinies of a large territory in these days of rapid change and liberal thought. And there is no question but that these rulers should come to their posts free from the trammels of local prejudice and tradition; and the time cannot be far distant when able statesmen at home or in the colonies will be selected to fill posts even so low down in the scale as Chief Commissionerships in India. Most people then will agree with me, when I repeat that the head of this autocratic local administration is to blame for the failure at Warrora. For nothing would have been easier at any time than for him to have thrown off the shackles of departmental environment, and made over this (to the State) white elephant to a company, whose sole business would have been to see that it did pay, and not have lent himself, through a series of years, to the squandering of Government resources to the tune of nearly a crore of rupees without any appreciable return.

Warrora is situated in the Chanda district of the Central Provinces, 45 miles south of Wurdha, the junction of the colliery railway with that of the G. I. P. Sandstone quarries abound about here, and the line and the railway works look business-like, and substantial pillars of solid stone 8 feet to 10 feet in height, and copings to the bridge parapets, many tons in weight, of a pleasant, yellowish, grey color, speak of solidity in all the masonry works. The rail track is on the broad gauge, and the colliery is a mile and-a-half from the Warrora station. There are two pits in working, Nos. 2 and 4, and one shaft, No. 5, is in course of being sunk; but owing to insufficiency of pumping power at the site, the work has been suspended. Mr. Foster recommended that, instead of an outlay in machinery, a gallery should be driven to it through the coal from the third seam of pit No. 2, past No. 1 pumping station, and so drain the water, and this has saved the Government a good deal of money. There are two pumping stations, and a third is being formed for the new Attock engine. This was brought down from the Punjab, and for its cost and carriage and buildings, there is an estimate of three lakhs. There is too much pumping

power concentrated in a small space; and the Attock engine will soon have to be removed at fresh cost to a place much further south, which way the coal dips. The coal pits form a triangle a quarter of a mile apart, and the works are on a slightly rising hill. There is one substantial masonry building for the Attock engine nearly ready, a few walls for Nos. 1 and 2, and brick and stone and mortar do not much predominate elsewhere. Iron roofing and sheeting are chiefly employed for the pit and engine sheds, and solely in the workshops. You have already sketched the earlier days of this enterprise, so I need not be largely retrospective. On the principle that a district officer is expected to be Jack of all trades—judge and revenue officer, agriculturist, accoucheur, and stone-mason, so each official in the D. P. W. is expected to be master of all branches of engineering. Hence are they, because their learning and experience extend to road-making and bridge-work, deemed capable of directing colliery, architectural, and marine undertakings. And this faith in their universal ability, and the want of discretion in choosing the proper management, had all to do with the failure at Warrora. When private concerns require skilled direction, they follow the only proper method to obtain it —Advertise. But if such a course were followed by the D.P.W., it would only call in question its individual and collective God-given attributes, and this could not be thought of for a moment. Before proceeding, it would be best to notice that the charges for prospecting, boring, and testing the coal amount to something like 10 to 15 lakhs!! In the D. P. W., lakhs are spoken of just as you and I would talk of hundreds. Mr. Ness, a mining engineer, with little experience of machinery, was appointed to the charge of the mines in 1873. The engine-power was not sufficient to do the work exacted of it, so little progress was made, and this with extreme difficulty, delay, and expense. The head of water had been greatly undercalculated, and new sets of pumps, larger and larger by degrees, were continually indented for and new engines and boilers were also from time to time brought out. The happy mean of what the work actually required was never hit on the head till lately. Constant breaks-down, flooding of pits, and the work commenced *de novo*, as if nothing had been accomplished during a long period; no honesty at all in the subordinate staff; excessive charges for labor and material ran up in the course of years to a fabulous sum. Coal of course was being extracted, but never steadily. Men who could advise were never consulted, but any experimental machinery recommended by any one in the department, and principally by the Chief Engineer, Mr. Armstrong (of road and building experience), was at once adopted.

Such is the doleful tale of the industry for eight long years, when an order came in 1879 from the G. I. P. Railway for 3,000 tons of coal a month. The manager, weighed down perhaps a little by a retrospect of the sad vista of years of failure, now began to hope that brighter days were in store if this order could only be fulfilled. Machinery that was manifestly unequal to the task both of mining such a large amount of coal and keeping the pits dry, was put to great strains to meet the demand on it, and as both achievements were beyond its power, the most profitable drawing coal was put full on. When the water made headway, it was sought to both wind and pump to the full, with the natural result—utter breakdown of machinery, consequent flooding of pits, and all work at a dead stand, to be done over again; and the stoppage continued for nine long months. It was now decided to change the local management, and a Cooper's Hill man, Mr. Reynolds, from the Ajmere Locomotive department, whose only *forte* was mechanical engineering, without even a knowledge of the rudiments of practical mining, was appointed in the stead of Mr. Ness. The machinery was now renovated, replaced, and fitted up to purpose, and the work got under weigh just as if it was a novel undertaking. But from the absence of mining knowledge, the work in the pits began to suffer, specially retarded by deficient air circulation, the assistant in charge of the underground section being no practical miner. Matters pulled along at haphazard, the yields at times being very large and at others the reverse, when in January 1882, fire was discovered in pit No. 2, a couple of hundred yards from the bottom of the shaft in a north-east direction, orignating, it was discovered, in the pyrites and excess of sulphur in the root coal. Then the fire, which it was thought had been silenced, broke out again and again, having travelled by the roof. During months, while the seam was on fire and the process of stopping and isolation continued, the work of quarrying was proceeded with, though daily many of those working at the stoppages, masons and *beldars*, were carried away insensible. This dangerous work continued till July, the fires assuming more and more formidable proportions, and threatening disaster. On the 23rd, a rather larger escape of noxious gases had laid many people low, and the Assistant Mining Manager, Mr. McDonald, being informed, he proceeded down the main pit No. 2, while ordering one of the underlookers, Hartland, to go down pit No. 4, and meet him half-way. The foul air was plentiful, having been let in through a breach in the "long wall," and about 50 men lay in a state of coma, who, if not taken away and revived at once, would certainly die. Mr. McDonald came on the scene for a moment, asked the underlookers, Turner and Hartland, if he could depend on them for carrying people away, and on their replying in the affirmative, retraced his steps, saying that he was "feeling very bad." He had not gone ten paces, poor fellow, when he fell in the gloom never to rise again. The underlookers, Turner and Hartland, worked very hard, saving many lives, till there were only left the latter, a native man, and a peon boy to take away a dead man. The underlookers had twice fallen down, and been brought to. The little peon boy now began to show signs of succumbing, and was being helped along by the native; while Hartland staggered beneath the dead weight he was carrying. The boy, Jania by name, seeing this, told the man, while the dreamy languor was fast overpowering him, "Never mind me; let me lie; take along the *sahib*; his life is more precious than mine," and merged into asphyxia. Hartland soon followed suit, and these two were carried out by the only man left, a Purdassie. For this heroic deed, the man did not even get a bonus, as did the others, of half-a-month's salary. If Government have been so wanting in their duty, I do not think the Humane Society will be. If they hear of the occurrence, I am certain they will not fail to make private enquiry, and award their medals where so richly deserved. When the disaster occurred, the local Manager was on a holiday excursion, shooting. While the General Manager from Nagpore was frantically rushing about the pit's mouth, begging knowledge from those he met as to the state of affairs below, and supplicating all to go down and save lives, a little native boy, amid appalling scenes of death and disaster, was plaintively craving to be sacrificed in place of his master. After the accident, all lost their heads; no one attempted to go down; the fires were allowed full head-way, and the only means that could be suggested to improve matters was to stop the pumps, and flood the colliery. For part of a month, this process continued, and the flames were not got under. In despair, the authorities arrived at the conclusion that the only way of solving the difficulty lay in placing the matter in the hands of Mr. Foster, a mining engineer of the E.I.R., who has also theoretical and practical knowledge of machinery. And now a change came over the scene, and it is not too much to say that Mr. Foster has saved this undertaking.

He at once set the pumps to work full power, blocked up, even from the shaft's mouth, isolated and totally abandoned the lit seam at No. 2 (till the fires should be got under), shut off its communication with the connecting pit No. 4, and dug down through about 40 feet of sandstone to the third seam. He also instituted the system of air circulation now in vogue, under the able superintendence of Mr. Barnes, mining captain—a Newcastle man. When Mr. Foster arrived, the practical output was *nil*. In six or eight weeks, it was 200 tons daily, at which figure it stands at present. You will have but indifferently carried out your programme, if your visit does not include a look below; for this the manager's sanction is necessary, and it is generally courteously granted. The pit-mouth is elevated some 20 feet off the ground, and this admits of the little trucks being emptied into the waggons on the rails underneath. As you descend in the lift with a rush, a strange sensation creeps upward from the soles of your feet; you feel as if you were gently falling down, down, but before you have time to think, you have traversed the space, 180 feet, and are already standing in one of the passages at the bottom. The atmosphere is not, as one would imagine, cold, but about the same as the temperature above. The drip, drip of water, its murmuring flow to the pumping dips, the walls of black, the gloom made palpable by the flickering lights, the damp, clammy look and feel of all around you—are not prepossessing in your first experience of cavernous depths. As you get away, however, from the shaft, matters mend, and now whitewashed walls, pathway and ceiling with many bright lamps about, make you fancy you are going through clean masonry tunnels. Not far off is the cabin; a good door leads into it, shining white with a new coat of lime. There are benches, and pegs to hang your coat and hat on; a clock is there also, and the place is dimly lighted. Here you disrobe and the stay is short, "to get your eye-sight," as it is called. In this neat little box, with 200 feet of ceiling and thousands of miles of wall and floor, one ought to feel secure. The mining captain, to whom you have been made over, kindly explains, as you proceed, the system of air circulation, and at the zinc doors, half shut and with tarpaulin screens, puts down his lamp to gauge the current.

I may here briefly explain the mode adopted of supplying the workings with fresh air. The main cause of the current is the furnace at the bottom of the shaft. This, sunk to below the seam, is partitioned off down the centre. The in-blast goes down the open part, and the return air up the portion screened off. The air descends, and is conducted to where the miners are at work by shutting off its passage into the worked galleries where no men are. From the shaft on the four sides, galleries or passages are cut, 12 feet in width and 45 feet blocks of coal are left to support the roof; then a gallery, excavated at right angles, 10 feet in width; then a like block left, a gallery cut, a block left, and so on, till the seam is at fault. All these passages, worked or not worked, if open, would convey the fresh air through them, and exhaust it; so, as these square workings are completed, the air must be shut from them to feed the parts being worked. Doors are put up and tarpaulins hung to regulate the draught, and

innumerable passages are blocked up with shale. After the air has fed all the necessary parts, it becomes hot and effete, and seeks a cold outlet to divest itself of foulness, and dissipate its density, so it is led right round the working to the blast furnace. If the volume were let into the fire, it would extinguish it, and occasion a disaster, so it is taken above, over a masonry arch, into the hot ascending smoke and fumes rushing up the part of the shaft partitioned. There is a strong draw created continually, and air sucked down by this simple means. There are no mechanical blast contrivances, and the work is done in a very efficient manner. When you consider that at each 45 feet there is a gallery at right angles to another, and these are continued in every direction in a network as far as the seam exists; and men are only at work at the further ends, it is, indeed, a most complicated matter both to give them air, and direct correctly the return blast, and only those thoroughly brought up to this work can solve this air problem. And Mr. Barnes, in charge of this intricate business, has lately come out from disseminating fresh air in dangerous and foul pits in the north of England, half-a-mile beneath the surface. As you make your way through the passages, little tracks of coal are continually being shoved along little lines down the centre, and on the side, water is flowing in a miniature stream. Further, and the air becomes denser, because there is no draught as yet, and there is a strong smell of powder from the blast shots let off. The whitewashed sides and roof give place to polished sparkling jet, jagged here and there, from which the water-drops glisten like gems, and every now and then the captain taps the roof to see where props are required. There are no safety-lamps used because there is no foul air (except when the coal is on fire underneath), and linseed-oil is only burnt. Now the wisdom of having disrobed is felt; you perspire at every pore, and the men are literally bathed in sweat. I am sure a course of this underground treatment would have a beneficial effect on fever patients who obstinately won't sweat. They (the miners) dig with pickaxes first right away under about 10 feet, a little above their sitting height; then the superincumbent mass is blasted down, after being notched above and on the sides, to direct the break. The seams of coal range from 9 to 13 feet, and there is only a thin belt of shale of about 6 inches running horizontally through them. The fuel possesses no free gases, and is on this account unadapted for lighting purposes, but it stands very high as a steam-producing agent. No. 2 pit is 250 feet deep; the third seam is being worked, and the outturn is 50 tons per day, which will be soon greatly increased. No. 4 is 180 feet deep, and has been worked for two years; its average outturn is 150 tons per day, and there are days in the month in which the work is perforce altogether stopped. The yield from the latter pit (some days so much as 300 tons) is the largest of any single one in India, already with great promise of better results. The excavating work is all let out by contract, the contractors getting Rs. 1-6 for every ton weighed in the waggons. There is a third pit, as I stated above, in process of being sunk, but this will not be ready for another year. This colliery, with only two pits working, and one of them only partially, is turning out 7,000 tons a month, and the coal being sold at an average of Rs. 6 per ton, this gives Rs. 42,000. The working expenses at a rough guess are Rs. 4 per ton, so this leaves a monthly profit of Rs. 14,000. When pit No. 2 is at full work, and No. 5, the new one, also, which it should be a year hence, the three pits will yield 1,000 tons daily, and with the expenses greatly reduced, as will be shown, say to Rs. 3 per ton, the annual profit will not be less than 11 lakhs. With three sets of pits, in a few years, the undertaking could yield over 30 lakhs net annually. Mr. Reynolds, the present local manager, adds to other useful and amiable attainments that of a first-class mechanical engineer. His library is a perfect record and history of the metals, and all over his rooms, even from the most obscure places, Iron in Gold and Steel in Bronze stare at you from the backs of works by Bessemer and other eminent metallurgists. In such a steely atmosphere, it cannot be wondered at if the master has imbibed a portion of the rough qualities of his frequent mental food, which finds an outlet in his expensive practical hobbies of moulding, fitting, and blast furnace shops. The machinery imported is of the best and most costly description, as are the workmen brought on excessive wage from Ajmere and the Punjaub. But casting on a large scale—18 blast furnaces, and fitting appliances capable of manipulating the most intricate machinery—are surely out of place in a colliery, and these shops are now the load which is bearing to the ground this resuscitating industry. Mr. Foster has recommended the entire removal of these expensive whims, especially as all work for the colliery and railway could be done at Nagpore where labor is cheap, and where Government have large necessary workshops. With the removal of these workshops, if it is also decided to remove their creator to some sphere where his practical abilities will find legitimate scope, I think a new era will dawn both for the colliery and for the manipulation of the metals in India. Mr. Foster combines, as I have said, mechanical acquirements with mining capability, and what he has accomplished in so short a time in retrieving an almost ruined industry is a sure earnest of what he is able to do, and there is no question of his ability to carry the works to the most successful issue; and should the intention of Government of placing him here be carried out, it is to be hoped he will be directly under the Government of India, and not under the harassing superintendence of the local administration. So, in a few years, the accumulated burden on these promising mines will be removed, and this is no dream, but practically possible; and if the authorities have the slightest doubt on the matter, let them make over their property, including the railway, to the company desirous of taking it over, and an opportunity will then be afforded them of curiously contrasting the results of their departmental direction with that of private management. The railway also should be paying, as it has a large passenger and grain traffic, besides the coal; and Warrora stands first of the stations in the matter of export. The trade is gradually concentrating here, instead of the ancient mart of Hinguughat, which is 25 miles from here, and about the middle of the line. Warrora is a rapidly growing town with 12,000 inhabitants, and it little dreams of what it is destined to be as the centre of the black country of India, when the coal worked to purpose will create manufactories for the wealth of raw material.

H. T. T.

P.S.—The block of masonry and iron buildings at the colliery would now be worth about Rs. 60,000; the Attock engine a lakh, and the other machinery, including pumps, another lakh.

EDITORIAL NOTES.

MR. A. STORMONT, the Superintendent of the Khandesh Government Farm, in submitting the report for the year 1882, takes occasion to notice prominently Professor Pasteur's discoveries in relation to the spread and prevention of disease among livestock. The health of the herd, says Mr. Stormont, was generally good, the only disease appearing being four case, fatal of course) of black quarter inclining to splenic apoplexy The victims were all yearlings occupying the same grazing ground, and the four deaths occurred within less than a week, two being on the same day. As the conditions popularly held responsible for the generation of this terrible malady were mostly absent, this peculiarly isolated cluster of cases must have been due to some accidental contagion, but from whence and how communicated it is difficult even to conjecture. Certain it is that the severe outbreak of two years ago was the disease's first visitation to this farm, and then not only were the carcases deeply buried, but the surface ground all about the neighbourhood of the graves was purified by burning thorns and herbage; in fact, the disinfecting measures were so thorough that no trace of active contagion could possibly have been left above ground. Very recent investigations of great value have shown that even such precautions are only temporary in their results. Professor Pasteur of Paris, in his recent address at the International Medical Congress on Animal Inoculation, states that the *sporules* by means of which this splenic fever is propagated had lately been found by himself and others in a pit in which animals dead of the disease had been buried for 12 years, and that these germs by experiment had been proved to be as virulent as those from the blood of animals recently dead. He has also elsewhere demonstrated that these germs are brought to the surface in the economy of earth-worms, and that cattle, while grazing, by chance swallowing some of these, become the leaven of a fresh outbreak. But the mere clearing up of the ætiology of the disease would be comparatively unimportant to agriculture, but for the cognate discovery that complete immunity from its infection is readily procurable by means of vaccination. The vaccine for this purpose is obtained by *cultivation* of the sporules found in the blood of an animal recently dead of the disease. Decoction of fowl has been found to be a suitable nutriment for these organisms, each generation as it ripens is applied to a fresh decoction, under certain conditions of temperature, and duration of exposure loses at each stage something of its original virulence. This series of successive attenuations goes on up to, it may be, the hundredth or thousandth operation, until the virus at last becomes null, and here the principle of vaccination is touched. Animals once vaccinated with this attenuated virus may with impunity come in contact with that of original virulence, or if they suffer from it, the effect will be of a passing nature, and not enough to cause death. The practical value of

this discovery has been placed beyond doubt by searching experiments, and even more so by its universal adoption in the French provinces. In the departments surrounding Paris no less a number than 20 thousand sheep, besides cattle and horses, were operated upon within the space of 15 days, and this limit was fixed only by inadequate capabilities of the Professor's laboratory. The vaccine is supplied to the public in bottles each, containing enough for 50 to 100 animals; it is injected under the skin on the thigh or other tender part with a small syringe, and no treatment is required for the pustules.

Mr. Stormont says that he has ventured to allude somewhat lengthily to this subject, believing it to be one of special importance to this country, where the disease is ill-understood, but so well dreaded, fraught as it is with such terrible consequences for the youth and cream of our flocks and herds.

THE following letter from Dr. J. Anderson, F.R.S., Honorary Secretary, Zoological Gardens, Calcutta, to the Secretary to the Government of Madras, explains the magnitude of the rabbit pest in New Zealand:—

The honorary committee for the management of these Gardens has received a pressing application for mongooses, with the object of introducing them into New Zealand for the purpose of destroying the rabbit, which in that colony threatens the very existence of the sheep farmer. Dogs, guns, and nets have been tried as a means of keeping down its numbers, but they have proved quite insufficient; and even, notwithstanding that during the year 1881, rabbit skins to the value of £57,000 sterling were exported from New Zealand, the threatened danger is still so serious, that it has been resolved to adopt some other measures, and to try, in the first instance, the introduction of mongooses.

It has been thought that the mongoose of the high region of Ootacamund (*Herpestes fuscus*) would be more suitable to the climate of New Zealand than the mongoose of the plains of India; and it has also been suggested that *Herpestes monticolles*, which inhabits the hill forests of Southern India, more especially those inland from the Eastern Ghats, might be acclimatized in New Zealand.

The committee have been asked to supply 100 pairs of mongoose, and they now take the liberty to ask the Government of Madras to assist them in procuring as many as possible of the two species mentioned, for shipment in the end of October from Calcutta. For any assistance in this matter, the committee will feel greatly obliged.

The Madras Government has ordered that every assistance is to be given for the collection and despatch of the animals.

THE Government Model Farm at Hyderabad, Sind. though the site is said to be the best that could be got near Hyderabad, as regards situation and soil, does not appear to be everything that could be desired. The farm is represented as "cut up by small kurriahs, bunds, &c.," and studded with brick-fields, besides being overgrown by "dub" grass, babool trees, and brushwood. Work was begun on the land on the 1st April 1881, and though bunds and kurriahs have been levelled down and filled in, trees and brushwood removed, brick pits and kilns dug up, and their adjacent rubbish cleared away and utilised as concrete flooring for farm buildings, it is estimated that several years of good tillage will be needful before the dub grass, whose roots form a regular net-work on the surface of the soil and reach to a depth of eight feet, is likely to be got rid off. This looks very like farming under difficulties.

The amount expended on ordinary farm work during the season under report was Rs. 1,610-0-10; on manuring for the current and following year, Rs. 72-3-4 were expended; and on dead stock, &c., and preparing the farm for cultivation, Rs. 2,124-11-10 have been paid, making a total of Rs. 3,807 expended during the year. The income is about the most unfavourable which the superintendent has ever had. The value of the season's crops amounts to only Rs. 772-1-2, and from all sources during the year Rs. 2,060-13-10 have been paid into the treasury, and there are still outstandings amounting on the 31st March to Rs. 2,378-8, including the value of farm produce not sold up to 31st March, and rent of *salaru* farm land not credited to the farm before the above date. The low return obtained during the past *kharif* season is chiefly due to causes, from which all cultivators in the neighbourhood suffered in a greater or less degree, as their crops happened to be early or late.

The very promising vernacular agricultural class for zemindars' sons we briefly noticed in our previous issue.

WARADI cotton is, in the opinion of Mr. Strachan, the Superintendent of Cotton Experiments, a less luxuriant variety of *compium indicum* closely related to the ordinary Sindi plant. It will not, however, yield so much clear cotton per acre as the common Sindi does. Both varieties are short stapled, and are equally useful for spinning purposes when mixed with cotton of longer staple. With regard to Bamieh cotton Mr. Strachan says:—"The few seeds of this cotton we had were sown along the sides of tobacco, &c., seed beds, and got in consequence more than ordinary attention; they were as usual healthy during the early part of the year, but at harvest time they behaved just the same as the ordinary Egyptian cotton plant has always done with me in Sind, the flowers or pods either dropped off or were attacked by bollworm. The yield was only a few ounces of bad seed cotton."

COTTON was the most extensive crop raised on the Khandesh Government Farm during 1881-82. In all, 152½ acres were laid down with the following result, which we take from the report:—

The total outturn of clean cotton was 15,916lbs., which quantity, divided by 152½ acres, the area sown (and therefore necessarily entered in the return,) gives 104½lbs. as the average per acre. This result, however, is not exactly correct, inasmuch as field No. 42 failed from drought, but subsequently yielded a crop of gram. Again, Nos. 41 and 45, which were partial failures, show yields respectively of only 30½lbs. and 45lbs., in *addition* however to the interstitial ambadi and other minor crops sown in the vacant ground. The effect of this correction is to raise the figures to 117lbs., an excellent general average for so large an area, and again an advance on that for the preceding year.

Some of the detail returns are yet more strikingly progressive, especially those of the Khandesh American, the best field of which yielded 228¾lbs. per acre, another gave 221½lbs., and a third 204lbs. The average of these three equals a return of a bale of cotton to the 1⅞ acre, a crop which even a Georgian planter would hardly despise.

The American cotton was all cleaned by the saw-gin, and got into the market at an early date. The Hinganghat portion is also sold but not yet ready for delivery. The total value of the two kinds is Rs. 3,170 and of the seeds Rs. 530—total, Rs. 3,700, or a net return of Rs. 25½ from the acre of ground, being one rupee in advance of last year. The saw-ginned cotton was sold at Rs. 5 per khandi above the best local rate. It was known to be worth more than that, but rural traders naturally experience some little feeling of dubiety in venturing on an untried article, and I was particularly anxious to watch the consignment passing from hand to hand through the ordinary local course on its way to the exporter, whom it reached, carrying a value of Rs. 15 per khandi higher than good Khandesh, which brings it considerably above best saw-ginned Dharwar. The export value then of this staple is no longer a matter of uncertainty. The opinion of spinners and others from time to time quoted in these reports, and the sale at an enhanced price of the last year's entire crop, together prove beyond dispute that it is fully equal to what is known in the English markets as *middling Orleans*. But this quality even is capable of improvement; in fact, European consumers are yet ignorant of the wonderful extent to which India is capable of meeting even their most fastidious wants. The best of the cotton was picked and stored separately, and its seed as usual reserved for distribution, a quantity having been sent to Chandor to introduce the crop in that part. It is satisfactory to find that this annual supply of pure seed, aided by whatever of its successive produce the people themselves may have saved, is now perceptibly affecting the staple of the neighbourhood, insomuch that the term

" Bhadgaons" is not uncommonly used as a standard by which to grade qualities of lower value. It is, on the other hand, the reverse of gratifying to find that so increasingly large a portion of the year's crop is badly mixed with inferior kinds, as the character and price of our cotton in the Bombay market must necessarily suffer in consequence, and as ordinary cultivators look forward with equal indifference to the development or extinction of the trade in even cotton, their richest crop, things are likely to go from bad to worse, unless some natural turn of the trade itself should bring about a regenerative influence. The introduction of the saw-gin would no doubt operate strongly in this direction, as the machine is not adapted to cleaning short-stapled cottons, the cultivation of which would thus be necessarily discouraged. It is, however, maintained by many well competent to judge, that the intelligent administration of a moderately stringent law is an indispensable safeguard to our great cotton industry, and it must be admitted that in the past two years' history of the trade, they hold a most powerful argument in support of their contention.

THE General Committee of the Agricultural Exhibition which it is proposed should be held at Madras in the February of 1883, offer the following prizes for the under-noted essays :—

	Prize Rs.
1. For an essay on water-lifts for use in different parts of India. Full details must be given regarding the cost and efficacy of each. It is desirable that drawings made to a scale should accompany the written account... ...	100
2. For an essay on manurial substances—animal, vegetable and mineral—procurable in India. The report must especially notice those substances which are as yet unutilized in the agricultural practice of India. The probable cost of each manure when prepared for use, and the uses to which each is especially suited, must be particularly noticed	100
3. For an essay on the management of soils under coffee, or tea, or cinchona in this presidency, in view maintaining their fertility	250
4. For an essay on the utilization of irrigation water, in view to obtaining the largest returns with the least injury to the soil, and least waste of water	500
5. For an essay on the best method of planting fuel plantations in India. Full particulars must be given as to the most suitable site for the plantations, their altitude, soil, climate, the varieties of trees, &c., with full details and cost of all operations	200

All essays must be legibly written on foolscap paper, and on one side only ; they must specify the number and subject of the premium for which they are in competition ; they must bear a distinguishing motto, and be accompanied by a sealed letter, similarly marked, containing the name and address of the reporter ; initials must not be used. The copyright of all essays gaining a prize shall belong to Government. When an essay is not of sufficient practical use, the judges are not bound to award the whole, or any part, of a premium.

The detailed prize-list may be had from Mr. W. R. Robertson, Superintendent, Government Agricultural Farm, Madras.

THE *Gardeners' Chronicle*, in noticing Mr. William Crooke's translation of M. Georges Ville's work " On Artificial Manures," has the following :—Physiologists, in the face of the conclusive experiments of Messrs. Lawes and Gilbert, will hardly agree with M. Ville as to the absorption of free nitrogen by plants, and as to the difference he draws between wheat, which absorbs its nitrogen in the form of ammonia ; beetroot, which takes it as nitrates ; and leguminous plants, which absorb it in the form of free gas, the verdict will be not proven. M. Ville advocates the use of what he terms a normal manure, comprising nitrogenous matter, calcic phosphate, potash, and lime ; not that these constitute all that is necessary for plant-food, but the other ingredients are already in sufficient proportion in most soils. For practical and comparative purposes, careful experiments with various manures on the growing plants themselves are more serviceable than analyses of soil, or of the plant itself. To rely exclusively on published analyses, either of manures, of soils, or of plants, is to grope in the dark, because so little is yet known of the changes that go on in the plant itself. But by experimenting in the way indicated, if we do not throw light on the method of operation, we yet gain results that are intelligible to all and beyond dispute.

THE Government of the North-Western Provinces has, it appears, consented to take fifty copies monthly for distribution of the Meerut Agricultural paper, the *Mazhar-ul-Zuayat*.

THE report on the cultivation of cotton in British Burmah for the year 1881-82 has just been issued. The total area under cotton during that period was 15,130 acres, or 198 acres more than it was in the preceding year. From experiments made for ascertaining the true yield of cotton-fields in British Burmah by actually weighing the cotton harvest on certain selected fields, it would appear that the average yields of fields wherever cotton is sown alone, is equal to 482lbs. of uncleaned, or 161lbs. of cleaned cotton per acre. In one district, Bassein, where the testing was very carefully done, it was even higher. On *toungya* gardens, where other crops are also grown with cotton, the average yield was found to the 122lbs. of uncleaned or 41lbs. of clean cotton per acre. The experiments made this year are not conclusive, and the testing of the yield of cotton per acre is to be again tried with the current year's crop. For the year under review, however, the local Agricultural Department appear to feel themselves justified in taking 160lbs. as the average yield of cleaned cotton per acre for fields grown entirely with cotton, 40lbs. as the average yield per acre of cotton grown with other crops on *toungya* gardens.

The total yield of clean cotton during the year was as follows :—

Cotton fields	...	... 173,121 lbs.
Do. toungyas	...	... 561,920 ,,
Total		... 735,040 lbs.
or		... 6,563 cwts.

The trade in cotton is confined chiefly to staple imported from Upper Burmah, the imports from whence have been as follows during the past three years :—

Year.		By River. cwts.	By Land. cwts.	Total. cwts.
1879-80	...	65,105	4,194	69,299
1880-81	..	9,400	264	9,664
1881-82	...	15,146	307	15,453

The cotton imported from Upper Burmah *viâ* the Irrawaddy during 1881-82, although considerably in excess of the quantity imported in the preceding year, is nevertheless valued below the imports of 1880-81. The 15,146 cwts. imported during 1881-82 is valued at Rs. 2,62,498, whilst the 9,400 cwts. imported during the preceding year is valued at Rs. 2,99,966. This depreciation in the value of cotton is ascribed to the fact of the crop in Upper Burmah not having been good. It would appear that the best quality of the staple was carried away to Western China through Bhamo, and the remainder, which was brought down to British territory, obtained comparatively low prices.

The quantity of cotton exported from British Burmah during the year under review was 20,553 cwts., valued at Rs. 7,36,782, against 18,684 cwts., valued at Rs. 7,38,965 in 1880-81, thus showing an increase in quantity of 1,869 cwts., and a decrease in value of Rs. 2,183. The depreciation is likewise due to the inferior quality of the article brought down from Upper Burmah.

Very little cotton was exported to the United Kingdom during the year, and the trade seems to be declining year by year. The exports during 1881-82 amounted to 1,126 cwts. only, valued at Rs. 16,741. The falling off in the demand is said to be due to the fact of the Burmese cotton finding no favor in the European market on account of its short staple, when cotton of better quality is obtainable from other countries. There has also been a falling off in the quantity exported to the Straits Settlements. The exports during the year were 9,740 cwts., valued at Rs. 1,81,163, against 13,099 cwts., valued at Rs. 2,61,844 in 1880-81. The decrease has, it is believed, occurred in consequence of the Chinese merchants having limited their purchases on account of the unsettled state of affairs in British Burmah during the time the monopolies were in existence.

The exports of cotton to the Indian ports during th year were as follow :—

	cwts.			Rs.
Bengal	... 4,394	valued at	...	84,197
Bombay	... 4,068	"	...	72,207
Madras	39			750

There has been a very marked increase in the quantity exported to Bombay, compared with the exports of the preceding year. The quantity exported in 1880-81 was only 371 cwts., valued at Rs. 6,803; the exports of 1881-82 therefore show an increase of 3,697 cwts., valued at Rs. 65,404. The increase in the trade witd Bombay is said to be due to shipments made on speculation in June by a few Marwaree merchants who had the opportunity of direct freights at low rates.

THE somewhat unfamiliar-looking words, silo and ensilage, relate to an agricultural process which, according to its advocates, is destined to effect very considerable changes and improvements in some departments of the farmer's work. A silo is "a cistern or vat, air and water tight on the bottom and sides, with an open top, constructed of masonry or concrete, and it is used to store in their green state forage crops, such as corn, sorgho, rye, oats, millet, Hungarian grass, clover, and all the grasses." The fodder which is preserved in these silos is called ensilage. The fodder is cut, and instead of being dried according to the time-honoured custom, and then stacked, it is at once, in its green damped state, cut by a machine into pieces about an inch in length, placed in the silo, pressed firmly down, covered over with straw and with heavy stones or weights, and then left to ferment and solidify until required for use. When winter comes and ordinary green food is exhausted, cattle and other domestic animals are fed with the ensilage thus prepared. They take to it readily, relish it, and thrive upon it. Six cows which, when fed upon the ordinary winter diet of turnips and dry fodder, gave 30 quarts of milk daily, when fed upon ensilage gave 35 quarts, and not only so, but milk of better quality with thicker, richer cream, and yielding butter of excellent flavour and wholesome colour, such as can ordinarily only be obtained when the cows are out to grass. There are other advantages which specially affect the farmer. The use of the silo obviously makes him independent of the weather, or largely so, so far as gathering in and storing the winter supply of food for his stock is concerned. The system saves time, toil, and trouble, and promotes peace, plenty, and profit in a dozen different ways which we need not specify here, and, in short, according to its enthusiastic American advocate—a Mr. Bailey, who has tried it and published the results in a book—its adoption would introduce an agricultural millennium. A well-known French agriculturist, M. Goffart, has, it appears, carried on this ensilage system with great success; Mr. Bailey has achieved within the last few years not less satisfactory results in America, and in both countries others are following in their steps.

ARBORICULTURE.

COMMUNICATED.

(Continued from page 447, Vol. VII.)

FOR persons wishing to raise forest artificially, and not knowing what trees to select, I subjoin a description of some of the most approved trees well suited for cultivation in the plains of India.

I.—CLASS, DICOTYLEDONEÆ.

NATURAL ORDER, LEGUMINOSEÆ.

Acacia Arabica (Willd.); H. *babool*, B. *báblá*.—The babool is well known to every one in India and highly prized. It is indigenous to India, stretching to Arabia, whence the name, and North and Central Africa. This tree supplies one of the *true gums* of commerce, extensively used in the arts and manufactures, also as demulcent in medicine. Babool is *arbuscula*, and not *arbor*, barely exceeding 80 feet in height with a trunk free from bough of 40 or more feet according to its position, and girth at maturity of 10 to 12 feet near the ground. It is one of the hardiest of all timber trees we have in the plains. I have raised it very successfully on *poor sandy soil* near the Goomtee at Lucknow, and have found it growing on very high, hot, dry plains of many parts of India where other timber trees would be nipped in the infant stage and fail in after growth, and in moist land near the foot of the Himalayan Mountains where babool fares far better, growing very rapidly, and presenting a healthy appearance. Some babool trees, 15 or 16 years old, are still allowed to grow on the moist land near the Sarjoo which have attained the height of 40 feet and 4 feet girth in this brief space of time. I say "allowed," because the natives cut down babool at a much earlier age, hardly allowing 10 or 12 years' growth. At Lucknow two small babool plantations of about a quarter-acre each, situated on the south bank of the Goomtee, near the O. and R. Railway line, are doing famously on sandy soil, having clayey sub-soil, notwithstanding the yearly rise of the river during the rains, which keeps three or four feet of the lower trunk buried under water for three or more days, without any injurious effect whatever on the trees. It is therefore clear babool will grow, because it is very hardy, on dry and high land and in the hottest part of India, but it prefers wet land and a humid climate, where it will grow to the best advantage. We have patches of land ½, ¼, ⅛, and in rare instances and localities one acre planted with babool, but fail to find hundreds and thousands of acres in one place planted with this really valuable tree. And then even these patches are denuded of the saplings after the 10th or 12th year. It is not understood why babool should not receive the universal appreciation in India due to it, when we know that its heart-wood ranks with *sheeshum*, but of a deeper colour, capable of receiving the highest polish, very strong, tenacious, durable, free from attacks of insects, withstanding decay under water, and not splitting under the strongest Indian sun; hence, in every way suitable for beams, rafters, doors and door-posts, furniture, cart and carriage wheels, well curbs of very superior order, farm implements of all kinds where wood is applicable, and for boat-building. This tree recommends itself also in the habits of growth of its roots; babool roots do not stretch sideways, but stretches straight down into the sub-soil in the longitudinal direction, which accounts for its being so very hardy, and requiring no care after the first five years' growth. During the first 40 years of its life babool grows very vigorously and attains its maximum height; it has then very little heart-wood, but mostly sap-wood of white colour. This sap-wood is far more durable and free from attacks of insects than many other sap-woods I know of. For this reason, and the short duration in which it is formed, the natives of India cut babool down and use the *kacha paka* wood (solid and unsolid). After the maximum height is attained the growth of the tree is confined in the expansion of its trunk, in the formation of the heart-wood—very slow process, because solid, extending from 5 to 700 years, when the tree attains the maximum size and quantity of heart-wood. The habit of the upper axis of babool is very branching and wide-spreading, requiring to be checked by close planting, gradually rooting up the surplus trees as the permanent trees advance in height. The bark and pods of babool contain tannin, useful for tanning leather. Goats are very fond of browsing on the tender branches and leaves, also the camels; the babool forest, therefore, in the infant stage, should be guarded from the depredations of these and other animals. The seed should be sown in June or July.

Acacia decurrens (Willd.); H. *bilati babool*.—Baron Mueller speaks in very high terms of this black-wattle acacia of South Australia. In the forest it is more lofty than *A. Arabica* in open localities, and equal to it if the latter be also in the same position. On account of its thick bark, this acacia has more tannin than all its compeers, including oaks and many other trees; but its timber is inferior to that of *A. Arabica*, fit only for a few uses, but is undoubtedly one of the best woods for fuel. For supplying tanning material, forests of this tree might be formed to be rooted up when the bark contains the maximum quantity of the tan principle, reserving some trees for ascertaining the quality of timber at mature age. Regarding the large supply of bark obtainable from one *A. decurrens* full-grown tree, Mr. Dickenson states that he obtained 10 cwts. or 1,120lbs., which means lbs. 336 to lbs. 604·8 of tannin, the bark yielding, according to analysis made by Baron Mueller, 30 to 54% tannic acid, a quantity sufficient, according to some tanners, to tan 20 hides. It is noticeable that this tree, in its early stages, grows at the rate of about an inch in diameter of its trunk in each year (Baron Mueller). Like *A. Arabica*, *A. decurrens* is raised from seed sown in June or July.

Acacia dealbata (Link).—This tree, called the Australian silver-wattle, is very valuable for many uses. Its timber is tough, very strong, and durable, therefore extensively used by coopers and other artisans, and as fuel of great heating power just suited to glass-manufacturers. The bark of this acacia is thin, affording tannin of less value than that of *A. Arabica* and *A. decurrens*. It is a pretty lofty tree, attaining the height of 150 to 200 feet in suitable localities. It likes humid soil and climate, will therefore grow to the best advantage in British Burmah, Lower Bengal, Assam, all along the foot of the Himalayan mountains, wherever the soil is moist, also on the banks of rivers in all parts of India. It is raised from seed sown in June or July.

Acacia fasciculifera (Mueller).—A valuable timber tree of South Australia suitable for furniture, and other things requiring good wood which might be easily worked, receive high polish, and possess good appearance. In good soil it will attain, in the forest, a height of 100 feet. The seed is sown in June or July.

Acacia harpophylla (Mueller).—Native of South Australia, supplying bark for tannery, and excellent timber of brown colour for fancy turnery. This tree attains the height of 90 or more feet. Like all acacias, it likes humid soil, and supplies a large quantity of gum. The seed is sown in June or July.

Acacia infesta (Bentham).—An excellent timber and bark-yielding tree of South Australia, useful for cabinet-makers and tanners. The wood of this tree is dark brown in colour, close-grained, firm, tenacious, and has yellowish stripes. Undoubtedly a very desirable tree for the plains of India. Raised from seed sown in June and July.

Acacia melanoxylon (Brown).—This is the best of all South Australian timber-yielding acacias. Its bark is useful for tanners, and the gum for technical uses. It attains the height of 80 or more feet, and the trunk is correspondingly thick. There is hardly any work belonging to cabinet-makers in which the timber of this tree cannot be used—*from* the highly polished billiard table and pianofortes to boxes, chairs, tables, picture-frames, railway cars, boats, &c., &c., are all made of this wood. This wood ranks in quality with the valuable walnut-wood. *A. melanoxylon* will grow very nicely in all parts of Upper India possessing humid soil, or on the banks of the rivers. It is very desirable that Lower Bengal, Assam, British Burmah, and Oudh should be well stocked with this really valuable tree. Raised from seed sown in June or July.

Dalbergia sissoo (Roxb.); H. *sissoo* or *sheeshum*; the Indian mahogany.—Undoubtedly this tree is very valuable. In the forest it is pretty lofty, attaining the maximum height of 200 feet. The sap-wood of sissoo is valuable only for fuel, and for no other use; but the heart-wood, heavy, of deep brownish colour, strong, close-grained, tenacious, and finely laminated, is valuable for buildings, carriages, furniture, boats, farm implements, and various other things. The foliage of this tree is mucilaginous, and possessing demulcent properties, is extensively drunk mixed with water, steeped overnight with the admixture of a kind of sugar manufactured in Benares, passing by the name of *Kucha* or *Benaresee cheenee*, for curing or alleviating venereal diseases by the natives of Upper India. Large forests of sissoo were found in the northern part of Oudh and N.-W. Provinces, especially in the Baraich district, which was once famous for sissoo wood, and has not altogether lost it yet, although the mature trees and forests are mostly gone, and used up without the precaution of planting new ones. At the present time mature sissoo is very rare, existing in out-of-the way and unfrequented localities. Large numbers of young sissoo trees are to be met with on road-sides, in all districts of Oudh, and in some of the roads adjoining this province, in the N.-W. Provinces, planted within the last 40 years; but I have nowhere observed sissoo forests formed, whether in Oudh or in the N.-W. Provinces and other parts of India. The sissoo tree grows fast enough in height, but in girth and formation and concentration of heart-wood it is very slow. Some sheeshums, at Lucknow, planted 40 years ago when Oudh was under the native rule, have not attained the diameter in the stem of more than 18″, which, excluding the sap-wood, would scarcely give heart-wood more than 9″ diameter. Some sheeshum trees planted at Sitapore, in Oudh, in 1859, 24 years ago, have not attained a girth of more than 4 feet, but are sixty feet high. Sheeshum requires humid soil of the calcareous order, where it will form flourishing forests. This tree is raised from seed sown in June or July, for which purpose seed should be gathered in its maturing season—February to March.

Butea frondosa (Roxb.); H. *dhák* or *palás*. The dhák tree is very common in the plains of Upper India, especially in Oudh and parts of the N.-W. Provinces adjoining Oudh. The dhák tree found in open localities growing on, dry arid soil, is very different from the dhák of the forest;—in the former locality, it is a small stunted shrub, but in the forest I have found it growing 40 feet high, with a girth near the ground of 6 feet. The dried flower of this tree going by the name of *tesoo*, is extensively used in dyeing cloths and other stuffs requiring a yellow colour. A kind of astringent red-coloured gum or *vino* exudes from the bark of this tree, brought to use by the natives of India in separating the dye principles of indigo. The root bark is converted into strong ropes, and formerly made into *palitas* for lighting native matchlocks, when the muskets and rifles now in use were not to be found with the natives. The wood is reckoned as the best fuel, and its charcoal is used in manufacturing gunpowder. Dhák leaves are sold to native shop-keepers for packing articles, and in Hindoo festivities they are used as substitute for dishes, plates, cups, and saucers. This tree is raised from seed sown in June or July. Dhák is very slow in growth.

Acacia catechu (Drury); *H. khair* or *katha*. A middle-sized tree, 40 feet high, found growing on the outskirts of the Lower Himalayas. The Khair tree is nowhere cultivated, but is found exclusively in the forests. With the natives of India it is one of the most valuable trees, on account of the dry extract (*khair* or *katha*, whence the native names of the tree, eaten by them with the leaves of *Chavica betle*, in dyeing, and in medicine as an astringent. The extract is obtained by boiling chips of the heart-wood of this tree, and reducing and drying the extract. For economic purposes this acacia might be grown in northern parts of Upper India. When mature the khair forest will yield a handsome profit to the owner. Except for the extract and as fuel, the wood of this tree is not valuable for any other use. Raised from seed sown in June or July.

Ceratonia siliqua (Linne).—The carob, or St. John's bread tree. A small tree, 30 or more feet high. It is extremely hardy, having been made to grow in very adverse soil and climate in India. It is a native of the Mediterranean regions. The carob tree is especially eligible for cultivation in our forests along the foot of the Himalayas. The value of this tree consists in the large quantity of edible saccharine pods it yields, resembling, in value, the dry dates, from which I could hardly distinguish it in taste. Baron Mueller, by analysis, has found 66 per cent of saccharine matter and gum in the pods of this tree. In Continental Europe the use of carob pods for feeding horses and all manner of agricultural live-stock is assuming immense dimensions; and in some localities live-stock are exclusively fed on the carob pod.

According to Baron Mueller the feeding value of carob pod is double of the best oil-cake having excellent fattening qualities. Forests formed of this tree will greatly profit the country in ordinary years by the nutritious food it supplies for the live-stock, and maintain them and starving people in years of scarcity. The pale-red coloured wood of the carob tree is valuable for many purposes and as fuel. The carob tree is raised exclusively from seed, which germinates very freely. The seedlings bear transplanting well; but for the formation of forest it will be better not to disturb the top root, allowing the trees to grow where the seeds are sown. I have grown and distributed large numbers of carob plants from ends obtained from Malta, some of which, planted in the Agri-Horticultural Gardens at Lucknow, sown and transplanted 15 or 16 years ago, are now fruiting. These trees are growing on *poor, sandy soil*, and not flourishing and fruiting well. Carob requires rich calcareous soil and plenty of moisture. It is very slow of growth during its first five years; but when once thoroughly established, it is fast enough, growing into a pretty large widespreading tree within the next ten years, producing abundance of sweet nutritious pods, not unlike, in appearance, those of the *Tamarindus Indicus*, bearing also the same quantity, or, even where properly taken care of, more pods.

NATURAL ORDER, EBENACEÆ.

Diospyros melanoxylon (Roxb.); H. *tendoo* or *abnoos*, the ebony tree.—A small tree 30—40 feet high with the girth nearest the ground of 4—6 feet, found growing in the forests of Oudh and N.-W. P., and other parts of India, in the same forest with *shorea robusta* and *terminalia tomentosa*. The ebony is very slow-growing, but lives to a great age. The heart-wood of this tree is jet black, solid, very heavy, strong, and capable of receiving the highest polish. This wood is called ebony, the generic term given to the heart-wood of many trees furnishing solid wood of peculiar structure. The sap-wood of this tree is also valuable. It is white, tenacious, does not split or crack under the sun, might be bent like a bow and not break, and is easily worked. It is much sought for handles of axes, spades, and for farm implements, wherever available. The fruit of *D. melanoxylon* supplies, on expression, a fluid which assumes a deep brownish colour, much used for varnishing the exterior surface of boats under water, and for fishing lines, to make them waterproof. It is a pity this valuable tree is not receiving the care and cultivation due to it, people near the forest ruthlessly cutting down small saplings for making handles for farm or other implements. Raised from seed sown in June or July.

NATURAL ORDER, SAPINDACEÆ.

Æsculus Hippocastonum (Linne.)—The well-known horse-chestnut tree of Central Assia. An ornamental useful tree 60 or more feet high, having stem measuring 10 feet in circumference. The seed of this tree forms food for domesticated animals, the bark is good tanning material, and the wood free from attacks of insects is used in making furniture. On account of its ornamental appearance the horse-chestnut tree is found in many gardens in the Indian plains. This tree requires humid soil and climate. It will succeed up to 10,000 feet in the Himalayan mountains, and flourish all over Burmah, Bengal, Oudh, and N.-W. Provinces bordering the mountains. Horse-chestnut tree is raised from seed sown in June or July.

NATURAL ORDER, MELIACEÆ.

Cedrela toona not *taona* (Roxb.); H. *toon*.—The Indian cedar. It is not known how this tree came to be called Singapore cedar. It grows wild in the Bahraich district in Oudh within a radius of 40—45 miles south of the Himalayan mountains, ascending up to 8,000 feet in these mountains. In open localities, growing alone, the toon tree is very umbrageous and well suited for roadsides. But it will not grow everywhere. It requires a humid climate, and moist and friable soil, where it will grow into a majestic tree with deep green foliage very grateful to the sight. Under favourable and undisturbed growth, in the forest, the toon tree acquires a lofty height and huge girth—200 feet high, and near the ground diametrically measuring 6—7 feet. The slightly aromatic heart-wood has a beautiful light red colour and is finely laminated. It is much in request for furniture, doors, windows, inside of ships and boats of European make. Toon wood is

light, very ornamental, but not so durable, because not strong as the solid and heavy babool, sheeshum, and many other first class woods. It sells much cheaper than the woods before mentioned, but the large quantity of wood of a single tree, in value, exceeds that of these woods. Like the babool, toon is very branching and wide-spreading, requiring to be checked by close planting, to be gradually thinned out. Toon grows from seed gathered in February to March and sown in June or July. The flower of toon yields yellow dye used in colouring cloth, called basante.

NATURAL ORDER, VERBENACEÆ.

Tectona grandis (Roxb.); H., *sagon*, B. *shegoon*.—The well known teak tree of Burmah. Slow but very valuable timber tree of lofty stature and huge girth, growing wild in Burmah. Straight as a rod, this majestic tree rises more than 200 feet from the ground, with the girth of more than 27 feet, growing thousands of years without showing the least sign of diminished vigour in growth. The value of the teak tree, as hitherto ascertained, lies in its timber used in shipbuilding, beams, rafters, doors, door-posts, furniture, railway carriages, and where plentifully to be had, sleepers also. Seed of teak tree has been imported into India from Burmah and trees raised therefrom, in the Botanical Gardens at Calcutta and Saharunpore, the Agri-Horticultural Gardens at Calcutta, Lucknow, and Lahore, the Wingfield Park at Lucknow, and various other gardens in India. These planted 25 years ago are seeding, from which plants have been and can be raised; but the trees themselves are mere saplings, 40—60 feet high, according to the nature of the soil and humidity of climate of the locality where they are growing, but they rarely exceed four feet in girth, which is mostly sap-wood with hardly an inch of heart-wood in the diameter. Teak braves the burning hot winds of the Indian plains, but does so at the expense of its growth. Lower Bengal all along the foot of the Himalayan mountains up to 6,000—8,000 feet above the sea are localities where, besides its native habitat, Burmah, teak will flourish well. Raised from seed sown in June or July.

(*To be Continued.*)

ON THE ECONOMIC VALUE OF THE JACK TREE.

(*Communicated.*)

NATURAL ORDER—*Artocarpaceæ*; *Artocarpus integrifolius*.
KNOWN IN BENGAL AS THE - *Kanthal*.

ALTHOUGH this is a tree that is grown near to every ryot's house in Bengal, and in fact can be grown on almost any soil, provided the climate is not a very dry one, its value has, I believe, never been fully tested, and these lines are written with the view of attracting attention to it.

Belonging as the jack does to the bread fruit order, its growth, in a climate and on soil where the bread fruit grows, is only a natural arrangement, and there is little doubt but that the jack trees in Ceylon are about the finest one can see.

The jack tree is grown merely for its fruit, which all residents in India are aware is very large, very luscious, and has a very strong smell of over-ripe fruit which very few Europeans can appreciate, but which the natives revel in.

The wood of the jack tree is very like the mahogany in "grain," and were it not for its bright yellow colour, it would be a great favourite with cabinet-makers. As it is, jack wood is used largely for all domestic furniture, and when put through a process of staining, is greatly admired and always commands a ready sale. The jack trees in Bengal do not grow lofty, but they make up for it in girth, and planks 20 or 24 inches across, sawn out of jack tree bolls, are not uncommon. Some years back, happening to see a number of jack fruit taken off a tree while still unripe, I experimented with the milky juice that exudes from the fruit stem. I gathered the juice, and whipping it up like one does cream, I secured a viscid mass out of it that looked uncommonly like (caoutchouc) India rubber. This mass I put away in the shade to dry, and in due course I found it get hard and springy. I then got several ounces of this "caoutchouc," and with it moulded a cup and a vessel like a milk jug. These mouldings were quite firm, but at the same time very sticky. Well, to get rid of the "stickiness," if I may so term it, I used some oil, having for result a polished, smooth surface. I then placed the articles on the kitchen smoke flue, opening to dry and brown; unfortunately I was called away suddenly, and had to absent myself for two or three days, and as I had left no instructions regarding my "caoutchouc" vessels, I found on my return no vessels at all, but a mass of viscid, dark brown, thick syupy fluid not unlike varnish. Now, from this experiment I deduce that the jack juice contains a substance like caoutchouc—elastic, leathery, water-resisting, and capable of removing pencil marks. I had not the chemicals to test the qualities of the substance, and to compare the same with India rubber, and, therefore, I do not feel justified in calling it India Rubber.

I was careful to test the quantity I obtained, and on apportioning it to the number of fruits I tapped, I found that each fruit could yield fully two ounces of milk, and from it I got nearly one-and-a-half drachm of rubber (I use this term till another is found, or the substance is proved to be other than caoutchouc.) If this substance is caoutchouc, and each tree yields only 20 fruit, the result would be four ounces of rubber per tree.* I have not tapped the jack trees in order to continue these experiments; but I have not the least doubt but that they could be tapped as the rubber trees are done.

Now, if we look at the fruit of the jack, it consists of a number of "flakes," each flake covering a seed. This soft covering is very juicy and sweet, and if heated with water and allowed to ferment, then distilled, it yields a wine of fair strength, but rather strong flavor. I see no reason why, with the aid of certain deodorizers, this strong taste and smell could not be mellowed down, and a full-bodied mellow liquor, not unlike some of the Marsalas, be produced. Again, the seed, when roasted and ground down, is a highly nutritious article of diet, very like the flour made out of the Trappa by the Cashmerees. I believe it contains a very large percentage of starch, and as such, could be utilised in a variety of forms. Many of the common jack trees yield a greater percentage of seed than those that are more carefully cultivated, and I have seen 80 to 90 seeds come out of one fruit. If these seeds be taken to weigh a third of an ounce each, one fruit will give us 30 ounces of flour, and twenty fruits, the produce of one tree, 600 ounces=37 lb of flour. Now, if we place the matter on a working estimate, it appears as follows:—

Say two acres of land—		Rs.	A.	P.
Rent at one rupee per bigha	...	25	8	0
Ploughing, cleaning, &c. ...	...	20	0	0
Seedlings	...	2	0	0
Planting 27 trees ...	...	0	8	0
Tending do for 48 months' at Rs. 4 per month ...	...	192	0	0
Total outlay	...	240	0	0

Against this we have a plantation of 54 trees; say the fifth year we have eight fruits on each tree, this represents an income of 8×27=216 fruits. The sixth year say twice 216=432 fruits, or in two years we have 648 fruits. These at two annas each for the eatable part of the fruits=Rs. 84 with 19,440 ounces or 1,215 lb of flour at 1 anna per lb, Rs.70, and 1,944 drachms or 121 lb of rubber=@ 8 annas per lb Rs. 60, or 84×76×60=Rs. 220, and as the yield increases very largely in a very short time, the plantation will repay every expense and be self-supporting. Lastly, the 54 trees when they cease to yield, which may be at a time when they have reached a circumference of 9 feet, could be sold at Rs. 20 each for the plants they would yield, and may be looked upon as Rs. 1,080.

SUGAR-CANE CULTIVATION IN UPPER WESTERN INDIA.

(*Communicated.*)

IN the *Indian Agriculturist*, Vol. VII, No. 12, p. 449, there is an excellent note on the sugar-cane cultivation in the Thonegwa, Shweygyin, and Hanthawaddy districts in British Burmah, drawn out by D. M. Smeaton, Esq., M.A., B.C.S. This note deals very comprehensively with all points in sugar-cane cultivation as practised in those districts; but the *modus operandi* found in Burmah, as contrasted with those of India, being faulty, because the Burmese cultivation is found deteriorating the quality of the cane, easily ascertainable by the paucity of saccharine matter in the sap of Burmah grown cane, I therefore offer the following remarks, which includes a few hints about the manufacture of sugars of all kinds in the Indian method, in the hope of their being serviceable to sugar-cane planters in British Burmah and elsewhere.

In these parts of India sugar-cane is most extensively cultivated both for chewing or sucking, and for the purpose of manufacturing *goor* (unpurified dry saccharine extract), *râb* called in Bengal *ghora goor* (jaggery or crystallized and uncrystallized sugar not dried), sugars of various degrees of purity on the methods of native and European manufactures, treacle, molasses (*shira* H.), rums, spirit of wine, and vinegar. We have a large usine known by the name of Rosa factory, a few miles from the Shahjehanpore sudder station, in the N.-W. P., bordering the province of Oudh, where extensive manufactures of all kinds of sugar, treacle, rum, spirit of wine, and vinegar, &c., are made. The cane this usine consumes comes, principally, from the sugar-

* Caoutchouc, gum elastic, or India rubber is a milky juice found in many plants, but most abundantly in the natural orders, *Moraceæ Artocarpaceæ*, *Euphorbiaceæ Apocynaceæ*, *Asclepiadaceæ* and *Papayaceæ*. The jack tree belongs to the *Artocarpaceæ*, and it is a question which experiment alone can decide whether rubber of sufficient economic value could be obtained from it.—ED., *I. A.*

producing districts of Shahjehanpore, Sitapore, and Kheru, the latter two being Oudh districts, and next neighbours to Shahjehanpore. In addition to this usine, we have no end of sugar manufactures on the native style in tahsil Gola, Districts Kheru, Sitapore, Bara-Bunki, Lucknow, and Cawnpore. The last three districts themselves produce very little sugar, but draw their supplies of unpurified sugar from Sitapore and Kheru, which these districts purify for conversion into *cheenees* of various kinds, *kand*, and *misrie*. Benares also manufactures much sugar, the unpurified supplies being drawn from the adjoining districts and from its own tahsils. In these parts of India the sugar-cane producing districts are, at present, for chewing or for sucking purpose, chiefly, Lucknow, Benares, Cawnpore, and Allahabad. In these districts, for sucking only, two principal varieties of cane are raised : the one has a yellow skin and when unripe green, and the other red. The former is called *Madrajee pounda* (Lucknow local name for Madras cane) ; and the latter *Bombaye pounda* (Lucknow local name for Bombay cane). These canes are thick, pretty tall (6'—10' high), each cane, including the tops (*agola*, H), weighing 2—4 seers of eighty tolas each, and are very sweet or comparatively insipid according to the amount of care bestowed on the cultivation, which includes, as a matter of course, proper soil and the quality and quantity of manure applied to the soil. No sap is ever extracted from these canes for conversion into sugar. It is, I believe, one of these two canes which is cultivated in Burmah. It is not known how these canes came to Upper India from Madras and Bombay, and from what length of time ; but are in cultivation from some centuries back. The canes raised for manufacture of sugar are altogether different varieties. Two of them are raised—one is called *kagdi ookh*, *ikh*, or *ookhar*, and the other *desee ookh*, *ikh*, or *ookhar*. The *kagdi ookh* is that principally raised and preferred. It is a thin slender cane, having yellowish thin and tender skin, can be crushed very easily with the rude appliances with the natives, less sweet than any kind of *pounda* (Madras or Bombay), 5—8 feet high, and weighing, on an average, 6—12 chittacks each (chittack—5 tolas) The other variety has a thicker stem, having greenish thick skin, of the same height, weighing each from 8—16 chittacks, less sweet than the *kajdi* variety; and some of them I have tasted, possessed alkaline taste, which comes, I believe, from their being raised on soil too rich in the alkali. In India the reason why *poundas* are not used for extracting sugar is not because of the paucity of saccharine matter in their sap—on the other hand they are much richer than the best *kagdi* and *dasee* canes I have tested, but because the *poundas* command a high and ready market for chewing and sucking in the large cities in India, when each cane sells from 3 pies to one anna six pies, also because the canes being thick the native *kolhoos* are unfit for pressing thick stems.

The soil preferred for sugar-cane cultivation in these parts of the country is of a calcareous nature (*kankrila zamin*, H.) having less humus and more lime. This kind of soil produces cane of the best quality, humus helping in augmenting woody fibre, and lessening saccharine matter in the sap. In Lucknow, however, the *poundas* are raised on poor sandy soil on the strength of the immense quantities of human ordure there available to the agriculturists at Rs. 3 to 5 per 100 ass-loads. After the proper soil is selected, mounds are raised, and four ploughings are given in the winter season, when the cultivators have finished their *rabi* sowings and are comparatively at leisure to attend to other works. Where manure is available the land is manured in various quantities in rural places with cattle-dung and ashes, and near the cities with human ordure. The ploughing and manuring finished, preparation for planting, in tracts embracing a large number of districts—Moradabad in the west and Jounpore in the east, including all of the districts of Oudh—commences in March ; but in other places, such as Allahabad, Benares, and Azimgurh, from April to the middle of May. The seed-canes are first cut into small bits, each cutting having 3 to 5 nodules (leaf buds, H. *ankhwaj*) a foot long. Each seed-cane affords 3 to 6 such cuttings, the tops (H. *agola*), and the lower part (H. *jarila*), are rejected as unfit for planting purposes. While the canes are being cut, if sufficient hands are available, the land is partitioned, water channels provided, and beds struck out. If the land be found insufficiently moist, it is irrigated, and when of proper consistency, generally the next day or the day after, planting commences. Women, children, and men, *khoorpes*, or any other implement akin to it, in hand, in a sitting posture, plant the cuttings in a sleeping direction, three feet from centre to centre of the cuttings in the same row, two inches deep, covered over with earth, and three feet apart from row to row :—thus an acre 660' × 66' having six partitions made by five water channels, 9 feet wide and 660 feet long, requires 3 × 220 × 63,960 cuttings obtained from 660 to 1,320 canes. Simultaneously with the planting of cuttings, are sown seeds of vegetables of the summer season, such as *khira* H., *shosha* B. (*cucumis sativa*) ; *tarboos* H., *torboos* B. (*citrullus vulgaris*) ; *karela* H., *corchey* B. (*momordica charantia*), *ghya toroe* H., *dhoondol* B. (*luffa agyptica*) ; *ara tore* H., *jhingey* B. (*luffa acutangula*) ; *louki* H., *lao* B. (*lagenaria vulgaris* :) *konhra* H., *koomro* B. (*cucurbita maxima*) ; and in rare instances some of the summer greens known by the general name of *sag* of the natural order amaranthaceæ. When these latter have germinated, gener[illegible] in a week's time, a watering is given ; and weekly heavy irrigation is never withheld till the rains have set in. Before the advent of the rainy season, the appendages sown are in a fit state for sale, and are accordingly rooted up, and sold in the market, leaving the sugarcane plants standing alone, which, at this time, receive a hoeing with the spade, manured, if manure is available, and earthed up.

The proceeds of sale of the vegetables, in all cases, pay the cost of seed-canes, and that of cultivation up to the time the vegetables are rooted up. Nothing further is done to the canes after they are earthed up till the end of September, when the under dry cane leaves are extracted and used as ropes or strings for tying up the bunches of stems, for preventing crooked growth and falling down from heavy weight the canes acquire at this time, and in the coming two months. If the rains have not been timely and in sufficient quantities, artificial irrigation is resorted to, not more than two or three times, in September and beginning of October. This finished, the canes are allowed to concentrate the saccharine matter up to the middle of November, when canes are raised for sale in the markets for sucking ; and up to the end of February, by gradually cutting from the beginning of December, when the sap is required to be converted into sugar, &c.

After the canes are cut the land is irrigated and properly hoed to admit of the stumps sprouting to supply seed-canes. Only those fields are irrigated for this purpose which have been harvested in November and not later than the beginning of December. This second crop of canes comes to the proper age for planting purposes by the latter part of March following : so that in India, within 12 months, we have two crops of cane—first crop for sucking or for manufacturing sugar, &c., and second crop for planting purposes. After the second crop of canes has been removed from the field, it is broken or ploughed up for some other crop. In India sugar-cane is never allowed to be grown on the same field two years successively, being a very exhausting crop.

Now, the outturn of a sugar-cane plantation is very various, no two fields producing alike owing to diversity in the cultivation, amount of care bestowed, and the quality and quantity of fertilizing matters in the soil. Each cutting grown into a bunch will produce from 3 to 15 stems of different heights and thickness, according to circumstances, containing 10 to 15 per cent. of woody fibre, 90 to 85 per cent. of sap, containing 10 to 35 per cent. of sugar, and the rest water. When cane-juice has only 10 per cent. of sugar, hardly any dry saccharine extract can be obtained, only molasses or very inferior dark-brown over-burnt jaggery can be had.

There are three reasons for the inferiority of Burmah cane—

(*a.*) It is harvested at a time (September or rainy weather) when the plants are growing, and the lowest percentage of saccharine matter exists in the stem.

(*b.*) The excessive humus in the soil on which sugar-cane is grown serves to augment the growth and quantity of woody fibre, and not the sugar.

(*c.*) The canes being planted on lands subjected to the tides, a great deal of water is absorbed by the plants which lessens the percentage of sugar in them, and the fertilizing elements of the soil which would form sugar are washed away with ebb tide, serving in still lessening the quantity of sugar.

I will now say a few words about the methods practised in India in the preparation of sugars, &c., by its natives, which I trust will prove interesting and useful to persons engaged in the sugar industry in India or in Burmah.

For manufacturing sugars, &c., the canes, tops cut off, are either passed between iron rollers (where Beheea mills are in use), or cut into small bits, by means of a chopper, *ganrasee* H., of about 6" length, and sap expressed in the ordinary native *kolhoos*, which resemble, in most respects, the *kolhoos* of the *telee* or oil-man. The sap obtained is strained through a clean cloth, and then boiled. A large *choolha* or oven is erected—more, if necessary, on the top of which is placed a large native-made deep plate-iron pan or *karhai*, filled with the cane-juice and boiled. The fuel used is the crushed cane (*megas*) from which sap has been extracted. After a few hours' boiling, sugar crystals are formed, when, if *râb* is the object, the boiling juice is poured into clean earthen *ghurras* ; and if *goor*, the boiling is allowed to go on till all water is dissipated leaving the residuum of a thick curd-like consistency, which is evacuated into shallow circular wooden or earthen pans, the inside of which has been well rubbed with mustard or rapeseed oil to obviate adhesion, to allow it to cool. When cool, in some places small lumps are extracted, shaped with the hand on a smooth wooden plank, pressed with the fingers and allowed to dry under shade. These lumps, weighing from 2 to 4 chittacks each, are termed *bhelee goor*, most extensively manufactured in most parts of the N.-W. Provinces. Where *bhelee* is not required to be made, as in Oudh, large deep circular wooden or earthen vessels are used, rubbed with oil as in the foregoing, filled with the thick residuum in the *karhai*, cooled, and solidified. This is called *pârâ goor* ; each huge lump, weighing from 10 to 40 seers, is called a *pâree*.

The different kinds of *goor* and *râb*—some of which are of beautiful golden yellow colour, while others, dirty blackish-brown—are owing to two main causes. The first is that the

saps which have been reduced to *râb* and *goor*, in the one case were rich in saccharine matter, requiring little boiling and had, in some few and rare instances, undergone a little purification—cows' milk, and the scum taken off; and secondly, in the other case, saps contained less sugar, therefore much boiling had to be resorted to, also no purification was made.

Kand and *misree* of different degrees of purification we find, are obtained from the stuff called *râb*, which are manufactured thus:—Huge baskets are provided, placed over *nândâs* if the quantity to be manufactured be small, or on *pucka* vats, if large quantities are to be obtained. In these baskets thick layers of river weeds (dried) called *sewâr* H., are put, the *râb*, after cooling, is poured into these baskets, and the tops covered. As is to be expected, the liquid uncrystallized sugar soon trickles down the bottoms of the baskets and collects in the *nândas* or vats. This is molasses or *shira*, H. When the molasses is well extracted from the sugar crystals, the baskets are opened, and sugar extracted. This is called *kând*, the shape, size, and weight of the *kând* depending on the shape, size, and holding capacity of the basket used. If *misree* is required to be made, the *kand* is not allowed to dry, but boiled afresh with water and milk, the scum scraped off, and the purified liquid poured in earthen vessels of any desired shape, where the sugar crystallizes, and gets solidified. *Misree* is highly purified sugar, and, some years ago, when the English sugar factories were not established in India, was much in demand for European gentlemen; but now the demand is lessened. The natives, however, like their native manufactured *misree*, and prefer it to the best English sugar, on account of caste prejudice.

These are the principal native manufactures in sugar; *cheenees* and *shukkurs* are inferior sugars manufactured by the *halwaees* from *goor* by adding lime as a purifier, moistening the *goor* with water, scraping off the scum, drying and rubbing in a large *kurhai* by means of *kurchool* H., or large iron spoon. *Cheenees* and *shukkurs* contain both crystallizable and uncrystallizable sugar, especially those manufactured at Benares, known by the name of *Benarasee kacha cheenee.*

REPORT ON ALOE CULTIVATION AT THE CENTRAL JAIL, HAZARIBAGH.

THROUGH the courtesy of the Inspector-General of Jails and the Superintendent of the Hazaribagh Jail, we are enabled to present our readers with the following interesting report:—

The aloe (*Agave Americana*), a member of the natural order *Amaryllidaceæ*, is a native of America, and has become thoroughly naturalized in countries bordering on the Mediterranean, in Africa, and in many parts of India.

Growth from seed.

It may be grown from seed collected from the tall, candelabra-like, stems thrown up by the plant after it has reached the age of from 5 to 7 years. The seed should be planted in a nursery of rows 18 inches apart, and the seed twelve inches from each other. The best time to plant them in Hazaribagh is during the rains, they will then rarely fail to germinate and throw out leaves 3 or 4 inches long by the end of the year. If, however, they are put in the dry season, they require watering at least twice a week. The young plants should be allowed to remain in the nursery till the following rains, when they may be transplanted to the hedge or plantation where they are intended to grow.

Growth from shoots.

This is the best method, because there is no chance of failure of germination. The labour of sowing is saved, and much time is gained. Young plants from one to two years old should be procured at the commencement of the rainy season, and put down where they are intended to grow permanently. If for hedgerows a ditch should be dug and the young plants put on the top of the earth thrown up, they should not be closer than 2 feet from each other. The holes in which they are placed should be 8 inches in depth, and the earth should be well pressed round them. No further care is then required, and in about three or four years the plants will grow quite close together and make an excellent fence. If it is intended to make an aloe plantation, the young shoots should be planted in rows ten feet apart, and five or six feet should be allowed between each plant in the rows.

Soil.

A gravelly or laterite soil appears to be best suited for the growth of the aloe plant. If the plantation is made on high ground, it is not necessary to make ridges to plant on, and the plant is quite prolific of young shoots, for experience has shown that they do generally well on the flat, but on low situations and hollows it is necessary to make ridges 12 to 18 inches high, the plant being very partial to a light, dry soil, while a damp and water-logged soil is death to it.

No manure is required, and it grows on the most stoney ground, where apparently there is not sufficient soil to support life in the plant. In some places it may be seen growing in the cleft of the rocks. We have not found it necessary to hoe or dig up the land near the plants, and weeds, grass, &c., do not appear to interfere with its growth.

From experiments which have been made here, the use of the expressed juice of the leaves as manure has appeared to accelerate the growth of the plant.

Cutting the leaves.

The leaves should not be cut until the aloe is six or seven years old, after it has thrown up its tall candelabra-like stem. Some of these grow to the height of 18 or 20 feet; they flower and produce seeds; before these are thrown up the fibre is weak and not fit for manufacture

Protection of plantation.

It is commonly supposed that cattle will not eat the aloe plant on account of its sharp-pointed leaf and acrid sap, but our experience has shown this to be an error. Several growing plants have had their leaves eaten, and very young plants have been found cropped close to the ground. It is desirable therefore to keep off cattle by means of a ditch (outside) and close aloe hedge round the plantation.

Value of crops per acre after the plants are 7 or 8 years old.

One acre of land may be expected to yield 7 maunds of fibre per annum, as it requires as much as 40 maunds of leaves to make one maund of fibre. There is no doubt about this, as repeated experiments have been made in this jail.

After the ground has been planted, no expenditure is required, and the cost of planting depends greatly on the distance from which the plants have to be brought.

Preparation of fibre.

After the leaves are cut, they are put through a crushing machine invented by my jailor, Mr. Dunn, which breaks the hard bark of the leaf and crushes out the juice. It has been found that a great deal of manual labour is saved by this process. The machine is not unlike a sugar-crushing machine. This process should be carried on as near water as possible. There the crushed leaves are pounded on a smooth stone with a wooden mallet until all the bark and woody matter are removed.

The fibre is then washed until the whole of the sap and dirt is cleaned out of it. It is dried in the sun, and is then ready for use.

R. COBB,
Superintendent.

CRITICAL NOTICES.

Elements of Sylviculture, a short treatise on the scientific cultivation of the Oak, and other hard wood trees. By the late G. Bagneris, Inspector of Forests, Professor at the Forest School of Nancy. Translated from the French (2nd Edition) by G. G. Fernandez and A. Smythies, B.A., Indian Forest Service. London: William Rider & Son, 14, Bartholomew Close. 1882.

BAGNERIS' Elements of Sylviculture, though based entirely on the conditions of soil, climate and species peculiar to France, is nevertheless, we agree with the translator in believing, a work which may be studied with advantage by forest officers in every country in the world. The general principles implied in forestry are everywhere the same, and it remains for observers in every country to study the special requirements of the climate and the species with which forest officers have to deal. While, then, there is much in the book under notice which is inapplicable to India, there are very few of its chapters which will fail to interest, or from which useful hints may not be derived. Professor Bagneris' manual was written mainly for the use of forest subordinates training in Forest schools, and brings together a mass of information which, as we have said, has special reference to France. The translators have done their work with care, and contented themselves with reproducing the original almost without note or comment. As themselves engaged in the Indian Forest service, an original chapter or appendix, or more copious notes with special reference to Indian requirements, would, in our estimation, have considerably enhanced the value of the book. In a comparison which is made between high forests and coppice in Part IV. Chapter I, the following interesting passage occurs:—

It is beyond dispute that in the same interval of time, high forest furnishes a larger yield than coppice grown under the same conditions; yet it is impossible to prove this rigorously, as it would be necessary to subject the same forest successively to these two separate systems. But observations tend to establish the truth of this proposition, which is besides an accepted fact among all foresters without exception.

Moreover, the produce of high forest has a wider range of usefulness. The quantity of large timber is more considerable, and volume for volume it contains a smaller proportion of unsound wood. However, the question at issue concerns only the range of usefulness, since coppice standards, as compared with high forest trees, yield timber which is denser, stronger, and composed of better nourished tissue on account of the unhampered development

of their crowns. For this very reason their wood is to be preferred in important constructions. On the other hand, timber grown under close leaf-canopy is in great demand for manufactures. It should be noted, too, that high forests which have been thinned, yield timber of medium density useful for almost all purposes, and lastly, it must be remembered that the consumption of manufacturing timber is far more considerable than that of building timber. Thus the superiority of high forest over coppice is completely established.

So far as fuel is concerned, coppice wood is better than the old trees of a high forest. But, on the other hand, the underwood of a forest under coppice is very nearly counter-balanced by the produce obtained from the thinnings made in a high forest towards the middle of the rotation.

Again, since high forest furnishes more considerable, as well as more useful, produce than coppice, it is evident that the revenue derived from it must be larger. But to obtain this larger revenue, it is necessary to accumulate a vast quantity of standing material, owing to which circumstance the ratio of revenue to capital engaged is small. This is equivalent to saying that those proprietors alone who do not consider their forests as a strictly pecuniary investment are interested in growing high forests, or in preserving those which they already possess, as such.

Lastly, a high forest, by the constant and complete manner in which it shelters the ground, ensures the improvement of the soil, and hence improved production in a higher degree than coppice. For still another reason, it can be shown that coppice is not so well adapted to improve the soil; it has been proved that the greater proportion of ash is found in young wood and in the outside layers of old trees; it therefore follows that repeated cuttings of the underwood impoverishes the soil more than would be the case in high forest worked on a long rotation.

From all these different points of view, it is evident that the private proprietor has no interest in converting coppice into high forest; on the contrary, it would be to his advantage to realise at once the standing material of any high forest he may possess and turn it into coppice. If he is owner of a forest of conifers, which is from its nature unsuited for coppice, he is always induced to limit the quantity of standing material to the lowest figure possible, and thus to adopt short rotations.

The State, on the contrary, has every interest in preserving its high forests, and even in converting its woodlands under coppice into high forests.

The chief reason why coppice is inferior to high forest is to be found in the shortness of the rotation. A single act of recklessness in the oft-recurring exploitations is enough to ruin a forest for several generations. The danger increases with the area cut every year. Certain forests there are, where the mischief caused by such operations carried on during a period of fifteen or twenty years, cannot now be repaired before the lapse of a century and-a-half. In a regularly worked high forest, on the other hand, when the rotation has been judiciously chosen and the blocks properly laid out, the damage caused by faulty operations is necessarily limited in area. Nothing short of the most careless thinnings can destroy the future of a crop, and regeneration cuttings must be very badly executed indeed for natural forces to be powerless to re-stock the ground with the valuable indigenous species, a certain amount of delay not exceeding a single period helping towards this end. But it is to be hoped that the progress of knowledge will continually decrease the frequency of operations executed at hazard or under a fixed idea.

There is an interesting supplement on the fixing of the dunes and the tapping of the cluster pine (*P. Pinaster*) for resin. A good Index renders the manual handy for reference.

The Mongoose on Sugar Estates in the West Indies. By D. Morris, M.A., F.G.S., Director of Public Gardens and Plantations, Jamaica. G. Henderson & Co., Jamaica.

THE substance of Mr. Morris' little pamphlet appeared in the *Field* some months ago. It may, however, be interesting to note the complete success of the mongoose as a rat-catcher. On sugar estates in the West Indies the mongoose has fully realised the hopes entertained of its usefulness. On estates where the mongoose was introduced in 1878, the following results were obtained:—

"In comparing the expenditure on an estate where I lived for some years, I find the present yearly expenditure for rat-catching shows £8, as compared with £80 spent in catching and poisoning rats, and rebuilding walls pulled down to catch rats. I take this from averages for five years before the introdution of the mongoose, as compared with last year's expenditure. This amount does not include the cost of poisons, baits, and traps, which would average fully £20 a year, making £100, as compared with £8.

"In comparing the quantity of rat-eaten canes destroyed before the introduction of the mongoose, I take the number of gallons of rum-canes ground during the crop preceding the introduction of the mongoose, and compare it with the quantity ground last year. This shows 14,850 gallons rum-cane ground before 1878, to 7,425 gallons ground in 1881; which, compared at the rate of seven loads of canes to a siphon of 450 gallons, shows eleven and-a-half hogsheads of sugar spoilt before 1878, compared with five and three-quarter hogshead spoilt in 1881, taking 20 loads of good canes to the hogshead—or a destruction of 10 per cent. as compared with 5 per cent. under existing circumstances." Again: "Some of the best cane lands on the estate I have just mentioned had to be thrown out of cultivation for years, owing to the impossibility of saving the canes from rats. This land is now being taken up again and put into cane cultivation."

A correspondent in the eastern portion of the island reports that "On the four estates on the north side of the Plantain Garden River, they (the mongoose) have made a saving of 75 per cent. in the expense of catching rats; and it is only in public places, where the traffic of man and beast is about sixteen hours out of the twenty-four that ravages of rats continue. In the sequestered parts of the estates, where there happen to be any stone walls or buildings affording favourite residences for the mongoose, as they did formerly for the rat, and where the ravages of rats used to be greatest, I may say that the decrease of rat-eaten canes is, at least, 90 per cent." And he adds, "In a word, as a sugar planter, I feel most grateful to the mongoose and his importer."

Another in St. Mary's writes: "The mongoose has fully realised the objects sought by its introduction, and it has saved on this estate £50 in rat-catching expenses; and at least 20 hogsheads of sugar (of the value of £16 per hogshead) per annum." A proprietor in St. James states that "the annual actual saving in rat-catching expenses and in rat-eaten canes on my estates, consequent on the introduction of the mongoose, has averaged from £50 to £200 at least, on almost every estate under my charge, according to locality." A correspondent in Trelawny writes: "I used to lose annually from 20 to 25 tons of sugar, *viz.*, 500 cart-loads of canes (rat-eaten) were ground and sent to distillery. Last year, after the introduction of the mongoose, only *one cart-load* was so used. On two estates of mine in St. James, similar results ensued."

A large proprietor in Westmoreland writes to the same effect, stating that since the introduction of the mongoose, "rats have almost disappeared from my estate. The annual expenditure for rat-catching and poisoning was over £300; it is now *nil*. The rat damage to canes was very considerable: it is now inappreciable."

These extracts might be extended to include nearly every estate in the island, and with similar results as regards the benefits which the mongoose appears to have conferred upon the cultivation of sugar. The annual saving to sugar estates, by the introduction of the mongoose, might very fairly be put down at 90 per cent. of the rat-catching expenses, and at 75 to 80 per cent. of rat-eaten canes. This, according to the estimate given above, would represent a total saving to the island of nearly £45,000 per annum.

SELECTIONS.

ECONOMICAL MANURING.

LECTURE BY DR. AITKEN.

A LECTURE on the subject of Economical Manuring was delivered in Castle-Douglas Scotland lately by Dr. Aitken, chemist to the Highland and Agricultural Society, to a limited but most influential audience.

Dr. Aitken said he was pleased to find so many influential farmers before him. It would be his endeavour to show them as clearly as he could the best and most economical way of applying manures to the land, and he could not do this better than by showing them the character of the different kinds of manure which they were in the habit of applying. Formerly, he said, the object of the farmer was to get as much as he could out of the land, to extract as much as possible out of the soil, and to make that process last as long as possible. In those days the best farmer was he who was able to take most out of the soil. But the process of getting as much as possible out of the soil could not last for ever. The manure applied to the land was really a part of the substance grown upon it, for the farmyard manure was really that part of the crops which was not sold off. In a small chart displayed upon the wall was shown the loss which the farm sustained in nitrogen, potash and phosphoric acid during a four-crop rotation. It would be seen that there was on an average an annual loss of 87lbs. of nitrogen, 80lbs. of potash, and 25lbs. of phosphoric acid. These were not very much, and to some might seem very small. It was not possible to take out of the soil all they put in, and although those figures might seem very small, yet the constant drain of those substances would soon very materially affect the fertility of the soil. He then pointed out the loss sustained by the soil by the exportation of animals. In the chart before alluded to, it would be seen that the loss in nitrogen and phosphoric acid was high, and the loss of potash, lime, and magnesium was small. He showed that nitrogenous matter and phosphoric acid were being taken off the farm in the carcases of animals sold, in a greater quantity than the potash; indeed, there were in the grain 33lbs. of nitrogen per acre taken off the farm, while in the straw there were only 12lbs. It was the same with phosphoric acid—it was high in the grain and low in the straw. It would be seen from these figures that farms suffered from want of nitrogen and phosphates rather than potash. Straw was rich in potash, and farmyard manure, which consisted largely of straw, was also rich in potash, while it was comparatively poor in nitrogen and phosphoric acid; therefore the application of farmyard manure was not always attended with the most satisfactory results. The farmer very soon found that some kind of manure containing phosphoric acid and nitrogen must be used to assist the manure from the farmyard to make up for its deficiencies. There are two ways in which the deficiencies of the farmyard manures might be made up. One was the using of mineral manures, and the other by using linseed or cotton cake high in nitrogen or phosphoric acid. There was no way of adding satisfactorily and

thoroughly, although slowly, to the fertility of the soil more than through the importation of feeding stuffs. It was frequently complained that the method was a slow one, and that it did not produce such brilliant results as mineral manures; but it suited light land better than mineral manures, and it would be able to tell its tale by and by, if not quite immediately. But it was important that they should have a ready return for the capital expended, and farmers liked to have a manure which they could count upon adding fertility to the crop to which it was applied. There were in the market, thanks to the energy of the manure manufacturers, an immense choice of various phosphoric and nitrogenous substances, and it became a difficult problem to the farmers which of those substances he ought to buy in order to produce the best results. The question was one very difficult to answer, because the application of manure depended very much upon the character of the soil, the character of the climate, and many other things, therefore it was of the utmost importance that the farmer should have some means of finding out for himself the best kind of manure to apply to his particular soil and climate, the best way to put it in, and the best time. These were considerations which required very great care and attention on the part of the farmer, and which could not be fully explained by merely reading a book or listening to a lecture, but by practical experiment. Now, he would firstly deal with nitrogenous manures, as the kind which was of the first importance, as that was the substance not only lost to the soil by animal and vegetable exports, but also by drainage. There were three forms of this manure—the albuminoids, ammonia salts, and the nitrates. In farmyard manure a large portion of the nitrogen existed in the form of albuminoids, and when those were allowed to ferment they gradually became converted into ammonia salts, which in turn became converted into nitrates. The albuminoid matter took a considerable time to ferment, and the nitrogenous or albuminoid portion of farmyard manure did not yield itself up entirely to the crops to which it was first applied, as its beneficial results were not experienced until several years afterwards. Ammonia salts was the most concentrated form of nitrogeous manure, and was not so easily washed out of the land. It had to be converted into nitrates before the plant used it, and before it was liable to be washed out. It was converted into nitrates owing to the action of a germ or small organism which was busily engaged in the fertile soil converting ammonia into nitric acid. This was very soon taken up by the lime, and in the form of nitrate of lime the plants were able to take nitrogenous food. But great care must be exercised lest the nitrates were not washed into the drains. Nitrate of soda very soon became nitrate of lime, and it was of the greatest importance that there should be a sufficient quantity of lime to assist in the conversion. If there was no lime, there would necessarily be a retarding of the process of nitrification. Ammonia salts were firmly retained by the soil—indeed, some soils retained it so powerfully that it could not be washed out. In the case of a clay land, or a land with a large quantity of humus in it, there need not be any great fear of the loss of ammonia. But when the ammonia became converted into nitric acid it had a great tendency to find its way into the drains. In applying ammonia salts we had to consider how long the ammonia required to lie in the ground before the plants used it. Nitrate of soda should never be put into the land except the plants were actually there, otherwise there was a great danger of the substance running into the drains. Those were general considerations, which might guide them as to which kind of nitrogenous manure to apply, and it would be seen by a little experiment how very marked was the difference in the power of the soil to retain the nitrogen in its various forms. Another question would present itself, namely, to what crop should a form of nitrogen be applied? It would be economical to apply to a crop with a long life a slowly acting nitrogenous manure such as dried blood, horn dust, and any other manure of that kind which are of the albuminoid class, and of a slowly decomposing nature. It required to be a long time in the soil before any result would be seen, or before it was converted into food suitable for the plants. Ammonia salts might be easily applied to strong land containing a large amount of humus before the time of sowing the seed, as it would be most disadvantageous to apply such a manure later on, because it was a peculiarity of nitrogenous manure that it was most wanted during the youth of the plant, and if it was late in being applied, it would perpetuate the youth of the plant and retard the time of ripening. The manure required to be applied so that it should come into contact with the roots of the young plants, therefore it should be put in the soil early. Nitrates acted immediately, and should therefore be put into the soil when the roots of the plants were grown and ready to seize hold of them. It would never do to put many of those slow acting manures to a cereal crop. If it were required to add nitrogenous manure to barley, it would be no use putting it in the soil in the form of 'shoddy,' or even bones, or blood, or any other slow acting manure, as it would not have time to decompose before the plant had reached the age at which it would be benefited by such manures no longer. Speaking of the cultivation of grass, Dr. Aitken recommended nitrate of soda, as the roots of grass retained it, and made it impossible that it should escape into the drains. Then as to phosphatic manures. There was a great variety of phosphatic manures, and they were sold in many different forms under many different names. Perhaps the most familiar form was the oldest of them all, namely, bone. Bones was a phosphatic manure, which differed from many others of its kind on account of its having nitrogen in its composition. It was a phosphatic and nitrogenous manure combining both those constituents, and it was an animal product, and corresponded with that which had been sold and carried off the farm. Bones had long been a very favourite manure, and were generally valued very highly; but in regard to them they had to consider several things. First as to the fineness of the bone. It was well known, but perhaps it was not so well-known as it and ought to be, that rough bones, bones which were called half inch bones, and crushed bones in bits varying from half-an-inch to an inch in length, were a very unprofitable form of application. He was recently at a farm where a handful of bones about an inch long were picked up, and which he was told by the farmer had been applied to the land by his father nineteen years ago, and there they were in a tolerably good state of preservation, showing that it was possible to put on that excellent manure in such a form as to make it not an economical manure. It was quite evident then that the finer the bones were ground, the more their surface was increased, and that would teach them that it would be much better to have them amply ground down. They were now beginning to understand that better, and to employ bone manure finely ground down. There was a practical difficulty in making fresh bone into a very fine powder. Even when very finely ground it contained a greasy substance on account of the oil that was in its composition, which kept it from rapid decay; therefore bones were a form of manure which they would not put on when an immediate result was required, but it was an excellent manure if they wanted an ultimate result. If they wished to improve grass then they would put on the crops preceding, or even the crops preceding that. A heavy manuring of bones might be applied to a turnip crop; then after that they could have a barley crop, and then a grass crop would greatly benefit by the bones applied to the turnip crop. There were two methods in which bones were manufactured for manuring purposes. First, the bones were subjected to a steaming process, and there was this fact that the process took out a considerable quantity of the oily matter, which enabled the phosphoric acid to be quicker in its action, and also enabled the bones to be more quickly acted upon by the plants. It put the bones into a more friable condition, so that the grinding bones by the steaming process, and the getting of them into a fine powder, was a matter for them still to consider. The more thoroughly they spread the powder, the more would the roots be benefited by the application. Another well-known method of overcoming the slowness of bones as a manure was to dissolve them, and that applied not only to bones but to every other phosphatic manure. There was one disadvantage which dissolving had in regard to bone, namely, that it destroyed the animal or the germ life which takes possession of the bone. The ordinary fermenting germs were readily destroyed, and they had no living fermentation in dissolved bones. What was known by dissolved bones was a manure which did not necessarily contain absolute bone. It was a name for all kinds of phosphatic manure which contained some bone or ammoniacal substance, and resembled the composition of what bone dissolved should be. They would see that there were plenty of ways of getting phosphates, and there were other and cheaper sources of albuminoid ammonia which might be added to it. It was quite probable that any imitation of dissolved bones was likely to be just as efficacious as the genuine dissolved bones. Having once put bones into sulphuric acid it was made not an organic substance but a chemical substance, and its special characteristic was gone; whilst phosphoric acid dissolved in that way would spread itself through the soil, and there was not the same fear of loss of phosphoric acid as of nitrates; in fact, it precipitates in the soil. Phosphoric acid was not easily washed out of heavy soils, but there were soils which did not so retain it. It would be a waste to apply dissolved bones to sandy soils, or more approaching sandy soils. It was not, however, uncommon to have not only bones, which were an excellent application to a sandy soil, but also other phosphatic manures, reduced to an exceedingly fine powder, and applied to the soil without being dissolved. There had been experiments made where in some instances insoluble phosphate had become useful for a crop, but these are few, and the general experience was that the dissolved phosphate was a better manure. There were some soils which were favourable for the application of undissolved phosphates, and those were soils rich in organic matters. It was extraordinary to find what results might be produced by perfectly insoluble phosphates put upon land rich in organic matter. The number of phosphates were very numerous, and farmers should be very careful in the phosphates they used for experimental purposes. Some phosphates go to a chalky powder, while others are ever of a gritty nature; but the more perfectly they were reduced to a powder the more certain was their action. Many of the discrepancies that had arisen in experiments with these manures had been due to the different forms in which they had been employed. It had been recommended and had been found beneficial to employ undissolved phosphates as a constituent of the manure heap. In choosing between soluble and insoluble, if they used the insoluble phosphate they did not put upon the land a large amount of sulphuric acid, for in all dissolved manures they were bound to apply a certain amount of sulphuric acid, but whether it did the land any harm or not was a question not yet solved. Some said sulphuric acid reduced the humus of the soil, bringing down the condition of the land and reducing its store of wealth. Potassic manures were limited to three varieties, and their application was not so important as the application of the other two forms. It frequently occurred that farmers declared that potash was of no use to them. But sometimes it occurred quite otherwise. He had seen cases where potash had made a marked increase in the crop; therefore it was for the farmer to know when to use it. There was something for the farmer to learn in another respect, and that was the time to apply it. Sometimes potash did harm by reducing the crop, but that must be due to the time at which it was applied. The land did not permit potash to go away rapidly, or to be lost by drainage; therefore, there was no need for putting potash upon the land exactly at the time it was required by the crop. Dr. Aitken concluded by showing the doses required by land, and recommending that a committee be appointed for the purpose of organizing a series of experiments.—*North British Agriculturist.*

TO MAKE FOWLS LAY IN WINTER.

THE following is an easy and by no means costly method for obtaining a regular supply of eggs during winter, even when the weather is at its coldest. I cannot say that I invented it, but I can say that I have practised it for a great many years. As soon as the cold sets in, that is about November 15, observes M. Garnot, in a French paper, I have a quantity of hot dung carried into the poultry house, enough to cover the floor from 10 in. to 12 in. deep. This is beaten down firmly and left till about December 1; then every day for a month the layer of dung is supplied with a fresh layer of from 4 in. to 6 in. deep. At the end of this time the dung is turned over to mix it well by which means an increase of heat is obtained, thanks to the successive depositions and contributions of the hens whose perches are above. And so I reach the middle of January, when I have all the dung removed, and begin the entire process over again; and this carries me on to the first fine days. By this means I am able to maintain during the coldest weather a regular temperature, and I have the pleasure of obtaining fresh eggs at a time when they are exceedingly scarce. The expense of this method is merely the labour connected with it, and in winter time labour is not dear. The manure which I take away is excellent—very superior to that which I have at the beginning, because the fowls' dung is added to it day by day. In this dung, too, the fowls find a large quantity of worms, larvæ, and insects, of which they are fond, and which they rarely get in winter time. I leave them at liberty to go out in the ordinary way; but they know that they should keep inside in unfavourable weather, and they stop and keep their feet warm on snowy days, when it is damp or when it freezes.—*Farm and Home.*

FOOD NOT FEATHERS.

THE *American Dairyman* has the following excellent article upon poultry, in regard to the present popular passion for breeding to feather to the sacrifice of useful qualities:—The chicken question presents an anomalous condition in this country. Wherever we go, north, south, or anywhere, we find farmers, merchants, mechanics, and sometimes even sailors, breeding poultry, contending at fairs, advertising through the papers, and raising a general hue and cry in behalf of their pets, and all on account of nothing on earth but the feathers. One would think from all the fuss that those people were breeding ostriches instead of chickens; that feathers were of more value in the market than flesh; that the American people preferred to wear feathers on their bodies rather than put flesh in their stomachs. Nothing finds favour with these chicken fanciers except the thorough-bred fowls that are simply bred to the feather. The size of the Brahma is sacrificed to the correctness of the tail and hackle markings. The Dorking has lost his breast in the struggle to preserve the flesh colour of the legs and the uniformity of the feather markings. How far this craze has gone in England we are not informed, but we know some of the best table fowls known to the trade originated there. In France not only are breeds of fine table fowls originated, but, according to all reports, they are still bred with an eye singly to table qualities; and not only this, but methods of feeding to the end of quick maturity, economy of flesh production, and perfection of flesh quality are closely practised and experimented with. The French seem to understand this question as a practical one, and go at it in a way to make fowls not only a pleasure to breed, but a profit to handle. Chicken food that is wasted by the ton in this country, as dead horses, stale bread, &c., is carefully husbanded and turned to the finest kind of chickenflesh in France. Our people are so fearfully squeamish about such things that, while they can stand and see the hen eat worms and carrion at her own sweet will, and chop her head off the next hour to put her in the pot, they will not hear of such a thing as feeding her on carrion as a business. The lady who eats the oyster raw from the shell is horrified at the Italian who does the same with the snail. It is a wonder to many people why Americans can succeed so well with fancy fowls, and yet meet with repeated and unvarying failure when they attempt to raise fowls for the market. In one they succeed, with the other there seems to be no profit. It looks as though the American character was built upon too large a scale to make a profit with fowls, unless he can get from 3 to 10 dols. a piece for his cocks and hens. No one seems to be able to reduce this thing to a purely business basis. It has been our pleasure to examine the equipments of many farms where it was intended to raise poultry on a grand scale; and generally, from the elaborate and costly fixtures, one would think the purpose was to raise children rather than chickens. It is very much to be doubted if a large establishment can ever be made a success from the start. Just as large oaks from little acorns grow, a large establishment must grow out of a small beginning that has developed a capacity in the owner for conducting a large business. We hope some day to see this, but not until the craze about colour markings has somewhat subsided.

INDIAN GARDENS.

IN addition to the gardens mentioned, there are the private gardens of Europeans living in India. Now, it might be supposed that in a climate and soil so favourable to horticulture, these would be first class, but such is not the fact. Anglo-Indians are ever on the move, and they don't care to go to the trouble and expense of laying down gardens for the people who come after them; still, in some places, the gardens—which are commonly called "compounds"—are fair enough. Desperate expedients, however, are necessary to make English vegetables, which are the things most affected, flourish well. Thus, one will see an amateur gardener—a colonel or commissioner perhaps—gravely sticking little pegs of bamboo into his cauliflower stems, to prevent them emulating Jack's beanstalk, and running up too quick; or a lady in her early morning *deshabille* carefully placing a lump of rock-salt at the roots of each asparagus plant, in the hope that so much kindness will induce the "grass" to grow. But gardening in India is not nice work for those who like to work themselves. Hideous grubs and insects are turned up with each dig of the garden knife with which we work, and sometimes the "mallee," or native gardener, is a worshipper of the cobra, in which case that serpent becomes dangerously familiar, taking up his haunt near the well, and turning up perhaps when least expected. Squirrels devour one's peas, and white-ants eat everything; and, as the rule, English vegetables, except those grown at a great elevation on the hills, are tasteless, and scarcely worth the trouble bestowed upon them.

With regard to fruits, there are few of the indigenous kinds which are worth growing or can be improved. Mangoes take too long to grow to be worth cultivation in an Anglo-Indian's garden; whatever is done to improve this fine fruit is done by natives; but the Indian mango has still a huge and inconvenient stone, whereas the "high cast" Mauritius mangoes are said to have had their stones improved right away. One ingenious English gradener, indeed, attempted to grow very fine mangoes by burying all the dead pariah dogs that are killed once a year at the roots of his trees, but with what result is unknown. Mulberries, in some places, grow in hedges, but the fruit is poor. Guavas are capable of the "higher cult," but they are altogether in the hands of the natives. Oranges, except in some places, are also poor, and no attempt seem to be ever made to introduce the finer kinds, as those of St. Michael, Malta, or Seville. Melons are very fine, but a melon garden in India is a very different thing from a melon frame at home. In the cold weather, when the Indian rivers have run down, and leave great wastes of sand, exposed, the melon gardener plants his seed broadcast. By-and-bye the whole surface becomes a vast melon bed, and in the hot weather the fruit is sold at the equivalent of 1*d*. or less each. The melons of Cuddapet, in the Madras Presidency, are famous, but as the rule, Indian melons, like all Indian fruits, want new "blood" introduced, for the seed is too often worn-out. The Persian melons, green fleshed, are delicious, and easily grown, but are seldom seen. But it is a rule in India that whatever was good enough for a man's forefathers, is good enough for himself, consequently there is little horticultural progress. Pine-apples grow freely on the west coast of India, sometimes under the shade of the immense cocoanut groves of those parts, but are much inferior in size and flavour to the pines of the Straits of Malacca. The pine-apples of Singapore are, perhaps, the finest in the world; they are planted on the hillside in much the same way as they plant tea on the Nilghiris, and are to be purchased at merely nominal price—one weighing several pounds can be had for a cent, or the hundredth part of a dollar: and the Straits pines enjoy the reputation of being so wholesome that they may be eaten to almost any extent with impunity.

There is a remarkable absence of fruits corresponding to our gooseberries, currants, strawberries, &c., in India. There are wild strawberries and raspberries, indeed, on the hills, but nothing resembling them on the plains. The fruits of India, like the flowers, seem to grow on large trees, and many of the commoner kinds, although eaten by the natives, are positively nauseous. In the jungles one sometimes comes upon trees loaded with fruit which looks good to eat, but which it is prudent to avoid. There is the jumbulum with its damson-like but disagreeable fruit; the nux vomica, which seems to bear oranges; the mowa, and many others. In the Malayan forests, however, mangosteen trees are very abundant, and it is a common thing to see the wild monkeys throwing this exquisite fruit down from the tree tops just like so many schoolboys up an apple tree. Once, when shooting on the Malayan Peninsula, my Malay "shikaree" gave me a peculiar and delicious fruit, of which I do not know the botanical name, and which I have never seen at any other time. It resembled a piece of honeycomb, but the cells were much larger. Each cell contained a sub-acid globe, of a flavour resembling the grape. Talking of grapes, the vines and the wines of Hindustan were once famous. Tavernier, Hamilton, and other travellers of ancient times speak of the red Indian wine on which, the Emperor Akbar used to get royally drunk. But wine is never seen now; at least wine of local manufacture. The Indian wine seems to have shared the fate of the Persian wine of Shiraz, which in the earlier days of our occupation of India, was thought so good that it was drunk at the tables of the English merchants at Calcutta, though wine is still made in Afghanistan, and the Emperor Baber thought there was no better. His memoirs contain many interesting allusions to it. But there is a prospect of India producing wine before long. The Maharaja of Cashmere has imported champagne and Burgundy wines, as also French vine-dressers, and his experiment is said to give promise of success. Remembering the ravages made by the *phylloxera* in the vineyards of France, the Maharaja ought to realise immense profits should his champagne equal that of Epernay. Grapes will grow well in many parts of India, even in the hottest places, but they are mostly white—of the Sweetwater kind. Purple grapes, dwarfed in the Japanese fashion, and grown in pots, are to be seen in some places, and are exceedingly quaint and pretty, the huge bunches of purple fruit appearing so very much out of proportion with the stunted vine that bears them.

Something may be said here of Indian gardeners, or "mallees" as they are called. Their cheapness is perhaps their greatest recommendation. Remembering that an ordinary gardener's wage in England is something like £1 a week, it is refreshing at first to have to pay a "mallee" only 10*s*. a month, but then the difference! The latter is a most unteachable person, and he is full of crotchets

and crudities. Worse than all, he is, as a rule, a humbug and a thief. If there is any choice fruit or vegetables about he will sell it in the bazaar, and say the squirrels or bandycoots ate it. One thing only he excels in, and that is the making of bouquets. Natives generally have a wonderful taste in arranging flowers—or shall I say, colours?—and their bouquets are masterpieces of floral art. Every native "malloe" has a garden within a garden—a garden of his own. In this he cultivates, at the least possible trouble, chillies, cucumbers, vegetable marrow, egg-plant, and such-like curry stuff, for himself and family. His melancholy song or wail, as he draws the garden water by buckets from the garden *bowrie* or well, is familiar to all Anglo-Indians, and can be recalled, however far from India they may be, by the slightest effort of the memory.

But gorgeous as are the Indian flowers in their flaring scarlet, crimson, and yellow colours, there are no flowers in India, after all, to be compared, for simple loveliness, with the wild flowers of the English spring. The pink and white hawthorn, the violets and daffodils of our hedgerows, are worth them all put together when the lark is singing in the sky, and Nature's beauties bring the recollections of our happy childhood vividly before us. Nor is there anything in India to surpass a pear or a cherry tree in full blossom. The "Gold Mohur" and the Bougainvillea may be more dazzling, but they are certainly not so lovely or so sweet. And let this fact act as consolation to those stay-at-home people who are discontented with their own modest English gardens because they imagine tropical plants are so much finer than anything they can grow there. It would be unfair indeed to say that Indian gardens have not a beauty of their own, but it is what the French call the *beauté du diable*—gaudy, meretricious, fantastic. One can love English flowers however humble they may be; but admiration at the best is all one can give to an Indian garden.—*F. E. W. Gardener's Chronicle.*

THE CULTIVATION AND QUALITIES OF ENSILAGE

SEVERAL correspondents having recently recorded in the columns of the leading journal their experience and observation of this new article of food for stock, as cultivated in France and in America, including a long article from Professor Thorold Rogers, Sir J. B. Lawes, Dr. Voelcker, and Dr. Lyon Playfair have lately written on the same subject. From their contributions we make the following extracts, beginning with the hon. baronet, who writes: —'Granting all that has been said in favour of ensilage to be true, its importance is not quite the same to the British farmer as it is to those who farm in France or on the other side of the Atlantic. The main object of ensilage is to secure a succulent food for consumption during the winter months. In the agriculture of the States and of France, such roots as mangels and turnips do not appear to occupy any important position as regards winter food for cattle. In the States—where the statistics relating to the area occupied by the general crops are collected and published—no mention is made of either; and in answer to inquiries on the subject, I was informed that the acreage grown was too small to be reliable. Unless, therefore, it is proposed that our farmers should place their roots in a silo, or substitute for them some other green crops, their interest in the value of ensilage differs very materially from that of those who live in countries less favourable for mangels or turnips. We have a succulent food of the best possible description already, and, if anything, we rather require a dry substance to mix with it than a still larger amount of succulent matter. The question, therefore, as far as we are concerned, is considerably narrowed. It does not affect those who make hay for sale, nor those who feed their grass, clover, or tares, in the summer; it merely affects those who convert a portion of their clover or meadows into hay for their own consumption; and it is a question for them to consider whether, on the whole, ensilage can supersede haymaking with advantage. No information on this point is given in the article on ensilage published in the *Times*. We are told, indeed, that the stock ate the food and throve upon it, but we are not told what was the amount of loss attending the process itself; or, in other words, for each 100lbs. of sugar, starch, and other digestible product put into the silo, how much came out?'

Sir J. B. Lawes is afraid of this loss in the silo, and refers to an American writer who states that Indian corn containing 5 per cent. of ash, when put in the silo, contained 9 per cent. when taken out. This he calculates to amount to a destruction of 40 per cent. of the vegetable matter, unfortunately, too, of the substance of the highest feeding value. This loss may be exaggerated, but Sir J. B. Lawes thinks it should be decided by experiments, as also the cost as compared with haymaking; and until this is done, recommends the British farmer to wait.

Professor Voelcker, F.C.S., writes:—'The object of ensilage is to preserve succulent cattle food which, like maize cut green, is incapable of being preserved economically by the ordinary processes of drying. In many parts of the Continent, and more recently in America, where ordinary English fodder crops cannot be grown and preserved in the field for winter use, recourse is had to ensilage of crops such as maize or sorghum. The summer temperature of our climate renders the profitable growth of such crops too uncertain for any farmer to depend upon. It must also be borne in mind that ensilage is not practised even on the Continent or in America for the conservation of grass or other equally succulent foods without the admixture of a considerable proportion of chopped straw. Grass of fair average quality by itself is not put into silos in these countries. According to the more or less succulent constitution of the green food, such as maize or sorghum, from 10 to 30 per cent. of chopped straw has to be mixed with the succulent food before it is pressed down in properly-constructed, walled, covered, and perfectly water-tight pits. Without the admixture of chopped straw or similar dry materials, grass placed in silos, according to my experience, derived from the examination of specimens which have been sent to me by experimental agriculturists during the last few years, turns into a sodden mass of repulsive smell and taste, resembling more rotten farmyard manure than feeding materials. During a discussion on ensilage at Boston, Massachusetts, in 1880, Professor Gussman stated most distinctly that, in his judgement, there had been no improvement over the old plan of making hay when the sun shines. Sir John B. Lawes directed attention to the great loss in sugar, starch, and other nutritive substances under favourable circumstances. I fully endorse his views, but would add that under adverse conditions the loss in the elements of nutrition will be still greater, and ensilage under such conditions may prove a complete waste of food.'

Professor Thorold Rogers, replying to Sir J. B. Lawes, says:— 'I should not presume to argue on practical agriculture with so eminent an authority as Sir J. B. Lawes, but I am at a loss to understand how he has concluded that so much loss on the given article could be resultant from storage in a well-constructed, properly-covered, and adequately weighted silo. The object of silo storage is the preservation of the article in a state as nearly like green forage as possible. Some slight fermentation there is, but there is little or no heat, and, as I was told, little or no evolution of carbonic acid. As to the greatly increased yield of produce from the food given, they who give testimony are unanimous. I saw the cattle, inspected the dairy produce, and learned what was the monthly yield of milk by cows fed on the system.'

Dr. Playfair says:—'For the last three years I have taken much interest in the progress of ensilage in the United States. This system of preserving food for cattle progresses with great rapidity, and this fact alone, in a country of such practical aptitudes, shows that it deserves careful attention. No doubt exaggerated estimates of its value prevail; but, with due allowance for these, the results are remarkable. My friend, Colonel Cannon, a well-known breeder of shorthorns in Vermont, has taken up the system with much caution in comparative trials of the new and old system of feeding, careful records of weights being preserved. So far as these have gone, he obtained an advantage of about 8 to 10 per cent. in the feeding power of the silo food. But it has various incidental advantages which induce him to give a large extension this year to his experiments. In fattening cattle, or in feeding them for dairy produce, it is of importance to induce the cattle to eat as much as they can properly assimilate. Now, if silo food and the ordinary food be put into the same trough, the cattle in all cases in which I have seen the experiment tried, take the former instead of the latter. To preserve food in silos many precautions are necessary, and I should be sorry to see our farmers rushing into the system with their limited experience. When carefully conducted, I have never seen a failure; though, on the other hand, I have seen putrid instead of preserved food turned out of imperfect silos. The greatest success has been with Indian corn, which is put into the silo just as the ears are being formed. My only knowledge of agriculture is scientific and not practical, and it will be for practical farmers to tell us whether, even with the vicissitudes of our climate, there are not certain parts of England which could grow this profitable crop up to this stage of its maturity.'

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Wednesday, the 29th November 1882.

W. H. COGSWELL, Esq., *President, in the Chair.*

THE proceedings of last meeting were read and confirmed.

The following gentlemen were elected members:—

Dr. J. B. Rudduck, Messrs. F. Wood and J. P. Scotland, and Baboo Pertab Narain Sing.

The names of the following gentlemen were submitted as desirous of joining the Society:—

E. Brown, Esq., Manager of the Sungma Tea Association, Limited, Darjeeling,—proposed by the Secretary, seconded by H. J. Leitch, Esq.

Manager of Woodlands, Cachar,—proposed by the Secretary, seconded by W. S. Cresswell, Esq.

Alexander Mann, Manager of the Nonai Tea Company, Assam,—proposed by G. U. Yule, Esq., seconded by W. S. Cresswell, Esq.

Manager, Otter Indigo Concern, Tirhoot,—proposed by the Secretary, seconded by R. Blechynden, Esq.

Thomas B. Walton, Esq., Manager, Equitable Coal Company, Limited, Seetarampore,—proposed by the Secretary, seconded by R. Blechynden, Esq.

Major R. Bartholomew, Deputy Commissioner, Jhung,—proposed by F. W. Tytler, Esq., seconded by H. A. Firth, Esq.

Major Duncan G. Pitcher, Cawnpore,—proposed by H. A. Firth, Esq., seconded by the President.

Sheikh Gholam Moheed-ood-deen, landed proprietor, Meerut,—proposed by the Secretary, seconded by Raja Suttyanund Ghosal.

His Highness the Nawab of Jaora,—proposed by the President, seconded by Raja Suttyanund Ghosal.

His Highness the Raja of Nursimghur, Bhopal,—proposed by the President, seconded by Colonel W. Kincaid, as a life member.

Rejoined—G. W. Shillingford, Esq., Bagracote Pillans Hât, *via* Silligoree.

CONTRIBUTIONS.

From the Government of Bengal—the Annual Report of the Government Cinchona Plantation in Bengal, for the year 1881-82, and the Annual Report of the Quinologist for 1881-82.

From the Government of Bengal—Report on the Administration of the Registration Department in Bengal, for the year 1881-82.

From the Smithsonian Institution—The Annual Report for 1880.

From the Editor—The *Tropical Agriculturist* for October and November, 1882.

From the Editor—Journal of the North China Branch of the Royal Asiatic Society for 1882.

From the Secretary—Journal of the Asiatic Society of Bengal, Part I of No. 11, 1882.

Proceedings of the Agri-Horticultural Society of Madras of 6th September 1882.

From Dr. George King, Superintendent, Royal Botanic Garden, —presenting ten plants of Musa Textilis, for experimental cultivation in the Society's Garden.

COMMUNICATIONS.

Japan Pea.

Letter from the Government of India with papers regarding the Japan Pea, and China Bean, the Soy Bean, alluded to in the proceedings of a meeting of this Society, held on the 2nd September 1881, as also Resolution thereon to the effect that the Government think it desirable that the cultivation of this Pea should be extended in this country, and stating that a fresh supply of seed will be procured from Japan, in order that further experiments may be tried.

BEE-KEEPING.

Letter from the Government of Bengal on the subject of Bee-keeping in India, and enquiring whether the Society can afford permission to Mr. Douglas, who has brought out some hives, to keep them in the Society's grounds at Alipore.

A reply has been sent that the Society will be happy to meet this request, and to afford Mr. Douglas every assistance in their power.

ALOE FIBRE EXTRACTOR.

Letter from the Government of Bengal, dated 18th November, intimating with reference to a previous communication of the 25th August 1881, that a model of the "Mexican Aloe Fibre Extractor" has been despatched to the Government of India, and that the model will be forwarded to this Society on receipt.

Letter from Mr. H. Preston, Director of the Botanic Garden at Trinidad, dated 26th September, accepting the Society's offer for an exchange of plants and seeds. Advises the despatch of a case of West Indian plants, and hopes shortly to send some roots of the Arachaca Edulis, in regard to which he writes as follows:—

"I have to obtain them from some hilly district on the main. It is very rarely brought over here as a vegetable. Indeed in Venezuela where it is collected it does not receive much attention."

SORGHUM.

Letter from Major Pitcher, Assistant Director, Department Agriculture and Commerce, N.-W. Provinces and Oudh, dated 9th November, forwarding sample of *goor* manufactured at the Cawnpore Experimental Farm from amber-colored Sorgho, also specimen of pulp prepared at the Lucknow Paper Mills from the refuse of the stalks, and soliciting opinion on these samples.

The following report kindly prepared by Mr. W. H. Cogswell, with reference to the above, was submitted to the meeting:—

"The samples above referred to are worthy of consideration, both being products of some value, if properly and carefully prepared.

"The plant is well known, Sorgho of Sorghum, the seed of which yields a hard food-grain, capable of being ground into good white flour. It is also used for cattle feeding purposes, the green fodder of the plant being highly nutritious and sweet.

"The sample of *goor* said to have been prepared from the expressed juice of this plant is very soft, pasty, sticky, and devoid of all granulation. In its present hard dry condition it would be saleable in the bazaar at about Rs. 2-8 to Rs. 3 a bazaar maund, but if subjected to a damp atmosphere or kept during the rainy season, it would quite change its character and become dissolved in the form of molasses, in which state it would be suitable for distilling into spirit only, and be worth about Re. 1 to 1-8 a bazaar maund.

"I am however of opinion that with care and cleanliness in boiling the expressed juice and better manipulation generally, this plant is capable of yielding a good marketable *goor*, that further efforts should be made to improve upon the sample now under consideration, and in doing so that details should be given of the cost of producing it, and that a larger sample be furnished.

"The samples of the cane-like stalks after pressing, prepared in the unbleached and bleached state for paper material, are too small, insignificantly so, to admit of a very reliable opinion being given. They would be suitable as short stuff for filling in the 'Pulp,' at a low price, and as such would make fair raw material for paper manufacturing; but the main questions for consideration are—what would be its first cost, then the cost of transport to the consuming market or paper mill, and whether the supply would be constant and to what extent. I submit it would be well in all such references as this one that large samples should be supplied to enable experts to give reliable opinions, and that full details of cost, &c., should be furnished, so that with such data at hand it might be seen if any good practical results would be the outcome of further investigation and trials. The subject is one of much interest and importance in the increasing demand for paper-making materials with which this country abounds."

GARDEN.

The Superintendent of the Garden reports that the tanks now hold a very good supply of water which will be invaluable in the coming dry season, that the labor force is busily employed in clearing all jungle and generally cleaning up the grounds, now that the pruning is nearly finished, and that the general average of germination of imported seeds promises fair, all things considered, but that he hopes to furnish the usual detailed statement in due course.

CACAO.

INCREASE OF CACAO CULTIVATION IN TRINIDAD.

IN the first half of 1882, the exports of cacao had risen to over ten millions of pounds against an average of eight millions, and the *Trinidad Chronicle* states:—

"The laying out of new land in cacao goes on unceasingly, as it has been doing over the last 12 or 14 years, the great majority of the plots, small at first, owned by small people *ci-devant* labourers and contractors, and cultivated by themselves, but by degrees forfeited to the merchants to whom they are indebted for advances, and by amalgamation converted into good-sized properties counting acres by the hundred and (the cacao) trees by the tens of thousands. There is no movement corresponding to this in cane; and the opening of new cane estates on any scale—and a large one, *ab ovo*, is the rarest of *rara avis*—goes on slowly indeed. It cannot be done without capital, a capital of thousands sterling, while a very small purse of savings will give a man courage to buy and lay down, in cacao and provisions, a little plot of ten or twenty acres. Yet it is pleasing to note that where a new line of road cuts through virgin land, as at Conupia, by the railway, buyers start up from the ground as it were that no one dreamt of, men in the town successful in business or trade whom no one had previously credited with a taste for cultivation, yet who, on being tested, have been found to be gifted with a somewhat Mechian capacity for the pursuit quite equal to, and in some respects possibly better, than old clod-plodders to the manner born, carrying into the new practice the habits of foresight and perseverence that had gained them their first successes and yielded them the means to enter on an untried venture.

"Mr. Fabien's place, *Enterprise Farm*, a piece of 300 acres, lies on the opposite or east side of the railway. He has a mile of frontage on the line, and is about a mile from the railway station. The farm presents, for Trinidad, a very varied scene: Liberian coffee is represented by 5,000 trees, the St. Anna hybrid coffee by 15,000 plants, the Tonca-beans tree by 1,000 plants, at present about five feet high, and which are expected to come into bearing in four years from this. Of tobacco, he has 25 acres, managed by Mr. Anderson, who brings Jamaica experience to the task: 5 to 6,000 lb. have been cured, or are now curing, of this crop, and some of it is on sale in town. Mr. Fabien, being apiarian as well, has imported some Italian bees, got sunflower seed, hives, and books and journals on the subject, from America; but in this line cannot yet speak of success, finding the *Qu'est ce qu'il dit* even fonder of his bees than himself, and that the latter were attacked also by a certain species of ant. In time, no doubt, he will find a way to neutralize these attacks and get a profit from his bees. He has succeeded in making a *Queso de mano*,—little hand-made cheeses weighing a pound, cream white like the big llano cheeses of Maturin we get from the Spanish Main, but much cleanlier. They have the same peculiar sourness and absence of fatty richness, though made from unskimmed milk we are assured, but of a flakey texture that some admire. For these cheeses, Mr. Fabien says, he has a demand for more than he now makes, though he gets half a dollar a pound for them. But his chief object in keeping a stock of milk cows was to supply the town with pure milk, a very laudable idea, to which a great many will wish success. The milk is brought to town by rail, and has a remarkable keeping property. We are not sure we have exhausted the list of experiments—enterprises we should rather call them, with those we have named. Enough has been said, however, to show the new spirit that has been evoked by the opening of the Southern Railway, and the certain extension of settlement that follows the judicious construction of improved communications. Like causes, like conveniences produce like effects here as in Australia or America, though on a smaller scale. If our ruling minds, freed from other care, would direct their thought seriously to the subject, we are persuaded they could attract settlement to the island at a much faster rate than it is now progressing at; and would not every interest in the conlony be advantaged thereby Who can doubt it?"

CINCHONA.

CINCHONA IN MADRAS.

THE Ootacamund correspondent of the *Madras Mail* discusses the prospects of cinchona cultivation in the Presidency :—

That it should rain on the Kartighi feast day is said to be lucky, in native estimation, but we have had just a little too much of it this year, and our 'growers' complain that their tea, coffee, and cinchona are coming to grief. Cinchona, of course, suffers least, it is so adaptable a creature, willing to flourish in almost any ground and at almost any altitude, from 7,500 feet down to 3,000, if but due regard be had to its varieties. Crown bark (*Condiminia*) may be seen growing far up towards the crests of the Dodabetta range ; red bark (Succirubra) succeeds best at 5,000 feet ; yellow bark (*Calisaya*,) and the more delicate hybrids (*Llanosa*, *Pubescens*, &c.), and also the recent varieties imported lately from Java, are, as distinguished strangers, accustomed to greater care being shown in their raising and bringing up, and a lower elevation to live in. They flourish well in an altitude of 5,000 to 3,500 feet, and repay their grower for the extra anxiety bestowed upon their education by a large yield of quinine. It may be said broadly that when the soil is good and frosts not severe, cinchona may be cultivated successfully from the crests of the hill-tops to the semi-tropical plateaux of Wynaad. A ride from Ootacamund *viâ* the Government plantation at Neddiwuttam, down the Guddalur ghat, and so on to Devalah and Cherimbady, on the borders of S. E. Wynaad, would not only convince the most sceptical of the advantages of cinchona growing, but also prove a source of pure delight, from its constant change of lovely scenery, flora, fauna, and ever-hospitable planters. Local causes, of course, affect the growth of the best intentioned cinchona ; the aspect, soil, and elevation may seem favourable, yet a wind round an unsuspected corner, a want of cover, or an access of frost, may destroy the best laid plantations. The unfortunate victims cannot explain their sufferings, so they die to allow their owners to learn by experience. It is interesting at the Government plantations at Neddiwuttam, at Deva Shola, and other places where crown and red barks grow side by side, to notice the points where one deteriorates and the other improves, the deterioration and improvement following upon elevation, prevailing winds, and other climatic causes. Cinchona growing is certainly our most paying industry, and unless some wonderfully effective febrifuge be shortly discovered, even those who now begin to plant ought to make a fortune from this tree of knowledge. The quantity of bark now going to market must in some measure affect prices, but allowing for a fall of 50 per cent within the next ten years (which is scarcely likely to occur), still an ample margin of profit would be left to any one with sufficient capital to pay out, and not expect to bring in for six years. The want of capital is the root of all evil in all our hill industries. Cinchona, gold, tea, and coffee alike, suffer from want of funds ; men believe they can make their fortunes by laying hold of the rope, and forget that they must go on pulling. And things are not quite evenly balanced too : the moneyed men probably have no application, the persevering men no money. But to cease moralizing and give some statistics will best please your readers, and I can speak from most reliable data. Roughly speaking, to purchase and bring under cultivation one hundred acres of cinchona would cost from one lakh to a lakh and quarter of rupees to the end of the sixth year ; the removal of bark can commence in the fifth year, and extensive barking during the sixth. All expenses, including interest at six per cent on outlay, should ordinarily have been paid, and half a lakh profit or more remain in addition. At the end of the sixth year of famine, comes the plenty following the famine, the lean planter will now become the fat planter, for he will have an estate to show worth from ten to twelve thousand pounds, and his five thousand pounds gained by sale of bark wherewith to enlarge his border. Is it surprising that I place cinchona foremost among mountain money-making ?—*Madras Mail.*

CINCHONA SALES.—The change made in the conditions of sale of East India Bark, under which the deductions for draft, tret, dust, and discount were abolished, and payment to be made upon the net re-weight, came into operation at the periodical auction on Tuesday, the 7th Nov., and producers are to be congratulated upon the result so far. The old allowances amounted to fully 10 per cent., and it was only natural to expect that buyers would make something like this difference in their bids, but such was not the case. It is the unanimous testimony of selling brokers that the prices paid on this occasion were quite as high, and in some instances even higher, than at the previous sale, when the former conditions were in force, so that, practically, importers realised an advance of fully 10 per cent., and yet the market for cinchona bark generally is by no means animated just now, as quinine has fallen to 8s. 6d., and stocks show a tendency to accumulate. No one will be surprised to hear that the importers of South American Bark have demanded that the new conditions of sale shall be extended to it, and this has been conceded by the trade.

CINCHONA SOILS.—Mr. John Hughes, F.C.S., has lately subjected to analysis a number of samples of soil from the Government Cinchona Plantations on the Neilgherry Hills, and he is preparing for the press a paper on the subject. He is of opinion that the wide range of quality in bark of the same species is mainly due to the difference of soil ; that is to say, to the presence or absence in its composition of the nitrates and carbon which form the food of the plant, and go to produce the alkaloids in its bark. Hitherto, scarcely anything has been known as to the chemical composition of soil best suited to the growth of cinchona ; for even Mr. Clements Markham, who is recognised as *the* authority on the habits of the plant, only tells us that in its own home, he found it growing in forest land—which is decidedly vague and unscientific. The result of Mr. Hughes' researches will therefore be most opportune and valuable, and may be the means of preventing much useless outlay of time and money in planting cinchona on unsuitable soil.

FORESTRY.

ROOT AND BRANCH.—I had a fancy some years ago that something might be done in the forestry of conifers by restricting growth to the terminal bud alone. For this end all the side buds of some Scotch firs were removed yearly as soon as they were well developed. My largest specimen is now a finely grown tree some 40 feet high. For eleven years successively it was operated upon as I have described -in fact, as long as I could get the leading shoot without the aid of a ladder. When this tree is put into the saw-pit it should, barring accidents, afford 11 foot boards of utterly faultless timber. Of course, if the laterals had been allowed to grow the plant would have been weight for weight larger at the end of the eleven years, but I think that in some fifty or sixty years hence the difference will be found inappreciable.—*R. Trevor Clarke.*

THE GARDEN.

NOTES from the *Gardeners' Chronicle.*—TOMATOS.—Tomatos should be grown in a light soil not too highly manured, as the plants will otherwise go too much to top, and they do not fruit until they have made a certain amount of growth, and have become well established. Another point is that when tomatos are grown in the open air trained to stakes, a yard in height will be found sufficiently tall for the plants to develope and mature their fruit, and while it is necessary to disbud freely and thin out the laterals, the tops of the plants should not be moved until the crop of fruit is set, and when this has happened, the plants need to be thoroughly thinned that sun and air may be admitted to assist in the ripening of the fruit.

A very large amount of tomato seed is required for sale : a great deal is obtained from America, but very large quantities of tomatos are grown in Italy to supply seeds for this country. The crop, it is thought, will this season be comparatively light owing to the prevalence of floods in the tomato-growing districts, which have destroyed many of the plants. A great quantity of tomato seed is sent to India, not so much in varieties as in mixtures of all sorts. Indian growers appear to give preference to a variety of sorts over individual quality.—*R. D.*

TOMATOS AS PICKLES.—Any one having any ripe fruits of tomatos will find they make a delicious pickle by merely placing them in a jar, covering with the best vinegar, and tying down securely for a fortnight; the addition of two or three capsicums improves them in some people's opinion; others prefer them cut open when fit for use, and a little of Lea and Perrin's Worcester sauce added. The small kinds, ranging in size from that of marbles to walnuts, are the best for the purpose. The small green fruits are also much relished by some, but they require to remain longer in the vinegar before using.—*W. H. Divers, Burghley.*

THE STORING OF TREE LEAVES.—There can be no doubt but that decayed vegetable matter, which may be considered the most natural fertiliser provided for plants in a wild state, is also the best fertiliser we can provide for them in what may be called an artificial state, where, whatever help they would get under natural conditions, through the natural decay of *debris*, we, through the operations on which a high state of keeping depends, deprive them of a chance of assimilating, and it thus becomes imperative to provide the best substitute we can. As the trees are now commencing to shed their leaves in earnest, those which were stored last year should be at once turned over into the place previously occupied by that which has been shifted to the soil-ground in readiness for use, and the space (which should be ample) filled with a fresh supply as they are accumulated. To carry out this matter a large space should be set apart in a sheltered out-of-the-way corner, one-half of which should be filled with fresh leaves every year, to be turned over to undergo another year's decomposition, after which it will be sufficiently friable for use.

CHARRED RUBBISH.—Another very useful fertiliser is formed from the *débris* collected during the season from lawns, flower-beds, and borders. Wherever there is a practicability of subjecting the whole of it to the action of fire from time to time, and thrown into a heap, it becomes a valuable material for renovating exhausted beds and borders.

DECOMPOSED MANURES.—It is oftentimes necessary to apply more stimulating material than the above, for which a due provision should be made. Thoroughly decayed manure from the cow-yard will be found the best stimulant to apply to hot and dry soils, but well-fed horse-manure is best suited to the generality of soils, and for the purposes of the flower garden there should be an ample store put by every year. It should be frequently turned over for aëration and decomposition, as it is best for use after at least two years' submission to the action of the atmosphere.

LOAM.—This material is such an obvious necessity in the flower garden, that I scarcely need remind the operator to take advantage of any leisure opportunity to secure a good supply. I prefer a good loam from off the chalk.—*John Cox, Redleaf.*

SERICULTURE.

AT the exhibition of silk cocoons held at Modhopore in the month of May, the number of exhibitors was 720 as com- with 447 last year. There was a large increase both of agriculturist and non-agriculturist exhibitors, and, but for disease among the worms which has now spread to the foreign stock, the prospects of the new industry would be very bright. Last year only silkworm-rearers from Gurdaspore and Kangra were present, but this year a few came also from Sealkote, Umritsur, and Hoshiarpore. The report submitted to the Government goes on to say :—

The result of the prevalence of disease among the silkworms has been a greatly diminished outturn in the cocoons. The falling off has been so serious that Messrs. Lister and Co. have had to obtain some part of the requirements of their filature from Bengal, and the Commissioner of Umritsur fears that, unless prompt measures are taken to replace the diseased by healthy stock, sericulture in his division will suffer "irreparable injury." The main original cause of the disease in Kangra and Gurdaspore is probably the uncleanliness of the huts in which the worms are reared, and apparently when disease has once begun in a rearing shed, it spreads by contagion. It appears from a recent article in the *Indian Agriculturist* that more than once silkworm-rearers in Italy have lost the whole of their stock from disease, and have had to depend for fresh rearing on ova imported from other countries. The Financial Commissioner agrees with Colonel McMahon in considering that there is serious risk of the extinction of a very promising industry. He thinks, therefore, that the Commissioner of Umritsur should be asked to submit, after consultation with the agents of Messrs. Lister and Co., a special report as to the measures he deems necessary, and as to the cost which the destruction of the diseased, and the supply of healthy, seed would involve. At present we are quite in the dark on the latter point. Messrs. Lister and Co. might, in their own interests, bear a considerable part of the expense, and the rest might be met by the district committees, aided, if necessary, by help from Government. The Financial Commissioner has called for a special report on the feasibility of the plan of bringing up and destroying all diseased worms. The extract from the Annual Revenue Report of Kangra, given below, will show that a good deal is being done in that district to encourage sericulture. It would be a good thing if some of the tea-planters in the Kangra Valley would take up the industry, for their example might teach the natives better methods. Sericulture is likely to make great strides in this district if it is properly fostered. A separate report has been sent to the Commissioner in connection with this subject, and the Madhopore fair. I need say nothing more now, except that the amalgamation of the Nurpore and Gurdaspore fairs at Modhopore was a most unlucky step, and that to insure any success in sericulture in Kangra, the fair must again be made local. Rearing sheds on proper principles must be built, if the worms are to be protected from suffocation and death. These should in the first place be built by the district and municipal committees. People should be taught to manage their worms on a proper principle, and should be taught the simple problem that, if x is the selling price of any article, the man who can produce it for $x-1$ anna is making a profit, while he who produces it for $x+1$ anna will in the end be ruined. It is only a difference of 2 annas, but it is the difference between prosperity and ruin. It is a difference caused by one sericulturist working on scientific principles and another by rule of thumb. Mulberries of the China and Phillipine variety should be planted in large quantities, nor should planting of country mulberries be neglected.

We have hitherto been playing with sericulture, but if we now exert ourselves there is no reason why it should not in time rival tea in its capacity for bringing wealth into the district. If we had only four or five acres of tea in the district turning out 1,000lb. of tea, the result would be inappreciable. Now that we turn out a few maunds of cocoons annually, the result is also inappreciable. If we turned out several thousands annually, and there would be no difficulty in this, we might consider that a fresh source of wealth was open to the people. In sericulture I consider we have as yet done nothing: we might do a great deal.

TEA.

THE RETAIL PRICES OF TEA.

SOME correspondence has been going on in the daily papers on this subject, and suggestions more or less practical have been made. It is insisted on that the grower literally outlays his capital to enable the retailer to make enormous profits.

We have before us the price list of a so-called "Agency," which has been recently opened (and which affects to introduce the quite new element of cheapness), where the following rates are quoted for,—

	Rs.	A.	P.
Choice Flowery Pekoe, per lb.	4	0	0
Flowery do.	3	0	0
Orange do.	2	0	0
Pekoe	1	4	0

These prices are, it is true, below the ruling retail rates, but even supposing the teas to be what they are represented, the margin of profit on auction cost would be at least 100 per cent.

We suppose the public would not be fools enough to pay high prices if they knew where to get low ones; and surely it is worth the while of owners to assist them to this end. The bulk of the Kangra and Kumaon teas are consumed in the district, and very largely through direct retail orders—that is, parties send to the gardens for parcels of 2lbs. and 5lbs. at a time, and teas so ordered are sent free by post. Why could not the same thing be done between owners' representatives in Calcutta and the residents of the lower part of Bengal? For distant places one or two agents might be appointed to supply circles otherwise too far separated. Then there are the railway refreshment-rooms throughout India, where special brands on a moderate commission might be the guarantee of stated qualities given by owners, together with the reduction of present retail rates which would be feasible, could not but attract the public, who would desert the present retail shops and bazaars, to their own considerable advantage, and to the profit of owners. The cheapness of the tea, further, might attract the middle class of natives, especially if their convenience was consulted by packets offered of sufficiently small weight. A certain amount of capital would necessarily have to remain locked up, but where there are so many public Tea Companies as are found represented in Calcutta, the strain upon each would be slight indeed. To induce tea drinking among the natives must manifestly be a work of some time, but we do not see why it should not gradually take place: only in this case native agency must be resorted to. Surely one trustworthy shop-keeper could be found in each principal native town who would be glad to exert himself for a liberal commission. To arrange this portion of the business a native traveller would have to be employed; but this would not cost much.

Of course combination, primarily, among the representatives of tea owners and companies would be necessary,—somewhat in the way of a syndicate; but there should be no difficulty about this. One paid assistant could do all the actual work. The teas contributed could, if desired, be bulked under the Syndicate's mark, and payment could be made for them in the ratio of quantities supplied.

There seems no reason no doubt that nearly the whole of the existing retail trade could be diverted from shop-keepers to owners, which latter would receive, even at sale prices greatly below those at present charged, double the rate they now get. True, the consumption of tea in this country is not gigantic, but it is several million pounds yearly, and China supplies, alone, 5 millions, which by proper organized effort on our parts, ought not to be the case.

The scheme we roughly indicate could of course be carried out by an individual or private company with sufficient means, but the desideratum of low prices to the public (yet handsome return to the owners) would not then be obtained. It may not matter to Mr. Tomkins, C.S., what price he pays for the tea he drinks (though it ought to matter to him whether he gets what quality he pays for); but there are a good many of the subordinate European and Eurasian class to whom price matters a good deal, and who perhaps have to go without the wholesome beverage because they cannot afford to pay the absurd prices now asked for it.—*Indian Tea Gazette.*

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A MONTHLY

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NOTICE.

SUBSCRIBERS to the STATESMAN, FRIEND OF INDIA, *and* INDIAN AGRICULTURIST *are informed that arrangements have now been made by which these journals will for the future be published under the general superintendence of the undersigned.*

All communications concerning the general business of the STATESMAN AND FRIEND OF INDIA *Office, Advertisements, and Subscriptions to the* daily STATESMAN AND FRIEND OF INDIA, weekly FRIEND OF INDIA AND STATESMAN, *and* INDIAN AGRICULTURIST, *should be addressed to the MANAGER.*

All communications regarding literary matter should be addressed to the EDITOR *of the paper for which it is intended.*

WILLIAM RIACH.

June 13th, 1881.

CONTENTS :

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGMENTS.

Report on the Administration of the Bombay Presidency for the year 1881-82.

Report on the Administration of the Madras Presidency during the year 1881-82.

Report on the Progress and Condition of the Royal Gardens at Kew during the year 1881.

The "Indian Forester."

Field and Garden Crops of the North-West Provinces and Oudh, Part I.

CORRESPONDENCE.

BOOKS ON AGRICULTURAL CHEMISTRY.

TO THE EDITOR.

SIR,—Will you kindly tell me whose is the best book on agricultural analytical chemistry, where can it be had, and for what price ?

RASIK BEHARI BISWAS.

Bissenpore, Bankoora, January 18, 1883.

NOTE.—Johnston and Cameron's *Chemistry and Geology*, 6s. 6d.; Blackwood, 1872.

Sibson's *Agricultural Chemistry*, with Preface, by Voelcker, 2s. 6d.; Routledge, 1867.

Anderson's *Elements of Agricultural Chemistry*, 6s. 6d.; Longmans, 1860.

Church's *Laboratory Guide, specially arranged for Agricultural Students.* John Van Voorst.

How Plants Grow.

The third and fifth are out of print.

Macmillan has also published a few short text-books, but so far as we know there is no special book on Agricultural Analytical Chemistry.—ED., *I. A.*

DIVI-DIVI.

TO THE EDITOR.

SIR,—Some seven months ago, the *Statesman* published a few observations—reproduced in the *Indian Agriculturist* of the 1st July last—regarding *Divi-divi*. Seedlings were recommended to be planted 16 feet apart each way, giving therefore 170 trees to an acre. After seven years an average production of 4 tons per acre of a probable *nett* value of Rs. 350 was confidently promised, and even an outturn of 10 tons was likely not to be uncommon.

As previously to the appearance of those observations, I had seen instructions from a very high authority, directing that *Divi-divi* trees be planted 6 feet apart each way, so as to give 1,210 trees to an acre, which themselves would probably yield from 1 to 3 tons, I cut out the observations in the *Statesman*, and sent them, through an official channel, to the gentleman who had issued the instructions just mentioned. He courteously answered as follows :—

"Without better certified information in connection with the plantations to which the *Statesman* article refers, it would be useless attempting to reconcile the discrepancies between this and the notes I sent to you. They are, as you observe, very considerable, but the article conflicts even more severely with many *natural facts*, from which it appears certain that the writer has not had the advantage of a practical acquaintance with the subject.

"Taking the article as it comes, we see that the writer in the first place finds fault with the 'Madras contemporary' for speaking of the *Tamarind* and *Divi-divi* as being somewhat like each other. He says they bear no resemblance whatever 'except in the form of the leaf,' but that the *Divi-divi* and the common babool are barely distinguishable.

"In all this the Madras author is right, and his critic wrong. From the sample of *Divi-divi* sent under separate cover you will see that tamarind is not at all unlike it, while the above prints show the leaves to be altogether dissimilar.

"The *Divi-divi* leaf is large and *unequally bipinnate*, while that of the tamarind is only *pinnate* or once divided. The babool, like the *Divi-divi*, has a *bipinnate* leaf, but is *equally* or *abruptly* pinnated, the leaflets having very little blade. The three trees under comparison are no more like each other in general appearance than are most other members of the same family and tribe, and could never be confounded on careful examination.

"The article states that cattle do not eat the *Divi-divi*; but, as a fact, they are particularly fond of it, so also are sheep, and I notice that my shepherds systematically carry all the suckers and other prunings into the folds as fodder for the flocks.

"The tree is described as very small when young, but under cultivation it grows into a fine big tree. One in the Collector's garden at Dharwar measures about 4 feet round the trunk and covers a considerable area.

"Having had a good deal to do with the propagation and distribution of this plant, I think it is certain I should have heard before of the extensive and systematically worked plantations spoken of in this article had they existed, and if 'ten tons is not an uncommon outturn' the article necessarily occupies a position either in the *export* or *local* market, which is not the case so far as I am aware.

"On the whole I am inclined to believe that the writer is confusing the *Divi-divi* with some other kind of tree. If, however, his facts are as genuine as they pretend to be, his statements are entitled to much respect; for my own part I should hesitate quoting such figures as an inducement to planters; much mischief and disappointment is continually being caused in connection with almost every new industry by the rash representations of enthusiasts that it becomes a duty of experimental institutions in summing up the results of tentative trials, to *under* rather than *over*-estimate wherever actual ones cannot be obtained."

Divi-divi plants being naturally semi-procumbent for a number of years, the same high authority recommended that they should be planted in *threes*, to admit of their being plaited together to form one suitable trunk. 1,210 groups of 3 plants each would therefore give 3,630 trees to an acre. Supposing that grouping served only to keep trees straight, and that the yield of a group ultimately be not more than that of a fully grown isolated tree, still, the observation in the *Statesman* really referred to *Divi-divi*. The exact number of seedlings to be planted on an acre remains unsettled. A distance of 6 feet each way between them seems hardly sufficient for trees said to attain a height of 30 feet and a trunk-diameter of about 16 inches. On the other hand, if 3 tons be a probable average yield per acre, it looks easier for 1,210 trees than for 170 to give 6,720lb weight of dry pods. With the first number, the yield of each tree would require to be 5½lb only; with the second, as much as 39½.

Which is it? The question is an important one. A very few who had embarked in such a kind of cultivation, and found out after seven years they had gone the wrong way to it, would be able to begin again.

BRITISH BURMAH.

NOTE.—It is perhaps best to say frankly that the paragraph about the *Divi-divi* was written (or passed for publication) by the then Editor of the *Indian Agriculturist*, since deceased, and the present Editor is not prepared to settle the points in dispute. The subject is of some importance, and any contribution to our knowledge of it, addressed to the *Indian Agriculturist*, will be gratefully received. —ED., *I. A.*

VINE DISEASE.

TO THE EDITOR.

SIR,—I beg to enclose, for publication in your valuable journal, if you see fit, some correspondence between myself and Mr. Minniken, Assistant Superintendent of Hill States, Kanawar, on the subject of the vine disease of that tract.

W. COLDSTREAM.
Deputy Commr. and Supdt., Hill States.

Simla, December 31, 1882.

From W. COLDSTREAM, Esq., Deputy Commissioner, Simla, to G. MINNIKEN, Esq., Assistant Superintendent, Hill States, Bushahr Division, Kanawar,—No. 600, dated Simla, the 31st July 1882.

SIR,—I request you will be so good as to ascertain whether the vine disease, which has so seriously of recent years affected the grape crops of Kanawar, is due to the ravages of the phylloxera, or to some other cause; also what remedies have been tried for the disease, if any, and with what effect.

In order to assist your enquiries, I enclose a wine circular of Messrs. Coyle & Co. of Dublin, which contains an interesting article on the phylloxera, with illustrations.

Copy of letter from G. G. MINNIKEN, Esq., Deputy Conservator of Forests, Punjab, to W. COLDSTREAM, Esq., Deputy Commissioner, Simla,—No. 75G., dated Bushahr, the 5th September 1882.

SIR,—In reply to your letter No. 600, dated 31st July 1882, I have much pleasure in sending you a few notes on the vine and its disease in Kanawar.

2. On enquiry I learn that the disease first made its appearance in 1850. At that time every village to the east of Wangtoo, as far as Spoo, had its vineyards: they were from one to three acres in extent, situated on terraces immediately above the river, and close under the cliffs which form the walls of the Sutlej glen. The soil in such places is loose and fairly rich, being composed chiefly of the detritus brought down by streams which water them, and of the adjacent gneiss cliffs. In these localities thirteen varieties of grapes flourished, and bore abundant crops of good quality, which were for the most part taken to Hindoostan and China, and exchanged for other produce.

3. The people, on seeing that the disease was spreading, seem to have lost heart, and many have converted their vineyards into grain lands, but no remedy has been tried. The disease has not abated from the first, and the thirteen varieties, which are named, are as follows:—

(1) Mogun, (2) Chodakhung, (3) Leegoon, (4) Chiligoon, (5) Rulba, (6) Ruglasoped, (7) Poregula, (8) Sopedolakhung, (9) Rispruse, (10) Rungsprey, (11) Urutkung, (12) Peodakhung, and (13) Kurmaley Safed; only two varieties, Ruglasoped and Rungsprey, have partially withstood the disease; these however are becoming more and more affected, and their total failure is a question of time, unless a remedy is discovered and applied. In many abandoned or neglected vineyards the vine may be still seen twining among the *débris* of the wooden frames on which they were formerly supported or climbing up trees. This tenacity of life induces me to think that the disease is not due to the *Phylloxera vastatrix*, and I see from the book you sent me that plants attacked by the phylloxera die out in four years; nor, on an examination of the roots, stem, and leaf, have I found any traces such as are described as belonging to this insect. The fruit appears only to suffer. As soon as the process of ripening sets in, some insect, unknown to me, must puncture the grape and deposit eggs, which become grubs, and cause the grape to split. On looking at the split fruit, I saw many of these, which are not readily seen with the naked eye; they are about a tenth of an inch, long, white transparent colour, with a gray spot on top and back of head, and finer than a silk thread. These may be well known; but in the absence of any information about them, I have an idea they may have originated in the rotten wood of the frames. However, they begin to destroy the grape in August, and I shall carefully watch for them next year, and hope to be able to give you further information on the subject. I have now in my garden at Kilba, a vine brought from the Agri-Horticultural Garden, Lahore, which bears a large fine-flavoured red grape, which fruited for the first time this year, and was not attacked. I have heard that a very hardy species which is free from the ravages of the *Phylloxera vastatrix* has been introduced into France with success, and I should like very much to get a few cuttings or plants for trial here.

The Indian Agriculturist.

CALCUTTA, FEBRUARY 1, 1883.

NOTES ON THE CAWNPORE FARM EXPERIMENT.

(10,695lb OF SALTPETRE CONTAIN 4,978½lb OF POTASH AND 5,716½lb OF NITRIC ACID.)

THE Cawnpore soil is stated to contain, down to the depth of nine inches, 5,717lb of nitric acid per acre, and as this acid is in combination with potash, we obtain 10,695lb of that nitrate, which, divided by 3, gives 3,565lb to every three inches of depth over the acre's surface.

It is further stated that this acre to the depth of 9 inches contained 16,335lb of potash, and if from this the quantity in combination with nitric acid be deducted, there remains of potash 11,356½lb, which is equal to 3,785lb to 3 inches in depth of the acre's surface. The nitrate of potash, 3,565lb, added to 3,785lb of free potash, gives, 7,350lb of saline matters to the acre, or 1½lb (24oz.) to the square yard, 3 inches in depth, or 8oz. (3,500 grains) one inch in depth, and this, divided by 9, gives 388⅞ grains to the square foot, one inch in depth.

Any soil, so highly impregnated with nitre and free potash, is a *nitrous soil*, and quite incapable of producing a wheat or any other grain crop. But we are told that this soil on being manured with saltpetre to the extent of 240lb per acre gave a remarkable grain-crop, yielding 15,605lb of wheat to the acre and a second plot 1,242lb to the acre.

If this assertion is to be credited, then the other one, as to the richness of the soil in nitre and potash, must be discredited.

10,695lb of nitre equal 130 maunds, 16 seers, to every 9 inches of soil in depth, and this, at Rs. 2 per maund, gives Rs. 260 as the value of the saltpetre per acre, against Rs. 58-11-6, the value of 1,605lb. (19 maunds 22½ seers) the value of the wheat crop at Rs. 3 per maund.

If the facts are to be believed, the proper crop to have been obtained from this soil was the nitrate of potash.

* It is evident, however, that a mistake has been made somewhere, and it is quite possible that the soil sent for analysis, was artificially* enriched with nitre and wood ashes before transmission to Roorkee. But if this was not done, then the Roorkee chemist has made an erroneous analysis, which, however, seems improbable, as potash and nitre being perfectly soluble in water, one boil would have removed both from the soil, and being held in aqueous solution, evaporation would have given a saline solution, whose crystals would have yielded saltpetre and the residue potash.

100lb of wheat will yield 2lb of ashes, hence 1,605lb will give 32lb. 1 6/10 ounces of ash.

100lb of wheat ash contain of potash and soda 31lb and of phosphoric acid 46lb. Thus the principal mineral matter needed by wheat is phosphoric acid, to 28lb of potash, and 15lb of lime and magnesia.

Does the analysis mention what quantity of phosphoric acid was present in the Cawnpore soil, as on this component would depend its productiveness in grain ?

"The craze among European farmers about nitrogenous manures" had reference to Chilian saltpetre or nitrate of soda. This nitrate contains of soda 31·3 and nitric acid 54·15, whilst saltpetre or nitrate of potash contains of potash 47·15 and of nitric acid 54·15. Hence it follows that nitric acid has a greater chemical affinity for potash, than for soda, and if potash be present in the soil and farmyard manure (which it is), the soda would give up its nitric acid to the potash, and it is to this combination that the increase of produce was due when soda nitrate was used as a manure. An acre of unmanured and gave 2,004lb of wheat, and an acre manured with 1½ cwt., or 168lb. of nitrate of soda, gave 2,606lb. or an increase of 602lb. (see Johnson's *Catechism of Agricultural Chemistry and Geology*, p. 53.) 1,000 parts of a rich English soil contain only 2 parts of potash and 4½ of phosphoric acid ; 1,000 parts of a rich French garden soil contained 4·8 of potash salts, and of phosphate of lime and magnesia 5·60 parts : of soda salts 6·70.

J. P. P.

ALOE CULTIVATION.

NOW that the recent experiments in the culture of the *Agave Americana* made in the Hazareebagh district, have proved satisfactory, it will be a matter of surprise if its cultivation on account of its fibre is not extended in many parts of India, not only by Government in some of the vast tracts of waste lands which are at present of no value whatever for other cultivation, but by private individuals who may wish to embark their capital in a new enterprise, and who would, no doubt, be able to obtain grants of land at low rates for this purpose. Not only does the actual manipulation of the fibre seem to be extremely simple as appears from the report of the Superintendent of the Central Jail at Hazareebagh, published in a recent issue of the *Indian Agriculturist*, but the cost of cultivation is a mere trifle when compared with that of hemp, jute, and other fibrous plants, the aloe rejoicing in the poorest soil and thriving where no other vegetation could subsist. The young plants having been set out in rows six feet apart, no further care is necessary, such as weeding, breaking up the soil, &c. ; and it would even appear that watering the young plants is superfluous, as the fact of its flourishing in dry and sandy soil and on bare rocks would tend to show that it is capable of subsisting on moisture chiefly absorbed from the air ; in fact, it is possible that with great care lavished on its cultivation, manuring, weeding, watering, &c., there would be an increase of sap and pulp, and a consequent loss in quantity and strength of fibre. It has been ascertained that the full-grown leaves of the aloe yield about one pound of clean fibre and half-a-pound of tow for every forty pounds of leaves, and that one acre would yield about 1,613 pounds of clean fibre at a gathering, "which," according to Dr. Roxburgh, "may be reckoned on twice yearly after the plants are of a proper age." The present price of the clean fibre in the European markets, we understand, is about £22 per ton, and there can be no doubt whatever that this price, notwithstanding the competition, well remunerates the cultivator after paying all freight and other expenses. There are now no less than eight aloe-fibre cultivating and extracting companies in Mauritius, who, we believe, are working a new process of extracting the fibre, and whose finances are in a very flourishing condition.

It is much to be regretted that a machine has not yet been invented for the economic and rapid extraction of these fibres, which would combine in one operation all the processes of macerating, scraping, washing, and heckling, as most probably the quality and strength of the fibres would be greatly improved, the primitive process of heating and steeping detracting considerably from its value, while there would at the same time be an important saving in labour. Such a machine, we believe, was recently made by Messrs. Price and Lacey of Bombay, but after making satisfactory experiments with a quantity of the wild plant, *A. Vivipara*, they stopped their works through a scarcity of raw material, having based their calculations on a belief that the supply of the wild plant was practically inexhaustible.

Should, however, the culture of the aloe for its valuable fibre receive the attention it deserves, we have no doubt that its extremely profitable nature will lead to a machine being ultimately brought to the required perfection ; and as it would in all likelihood be capable of treating all indigenous fibrous plants, such as the *musa*, *Sansivera zylanica*, &c., which, like the agave, require maceration and scraping, there is no reason why the industry should not eventually become a large one in India, where fibrous plants of all descriptions abound.

A. A. L.

THE SOUTHERN EURASIAN COLONY.

THE Eurasian land scheme in Mysore is an effort of considerable pretensions. We propose giving a brief outline of the objects and aims of the Eurasian and Anglo-Indian Association in regard to this scheme, which looks very well on paper, although it still remains to be seen how it will work practically.

Within the two and-a-half years of its existence, the Eurasian and Anglo-Indian Association of Southern India claims to have accomplished much. It claims to have, to some extent, extinguished pauperism and false pride, modified the tendency towards reckless borrowing, provided work stimulated education, promoted sobriety and economy ; in short, to have improved the condition of the Eurasians' of Southern India generally, and it is now about to enter

* By all accounts, a good deal of friction has existed amongst employés of the Cawnpore farm. Saltpetre is made at Cawnpore, and solution of wood ashes concentrated, and added to nitrous earth enriched with saltpetre, would have produced such a soil, which, after being dried, may have been sent to Roorkee. J. P. P.

upon the chief work it has set itself to accomplish—namely, that of settling Eurasians and Anglo-Indians on the land. It will try to lead them to undertake agriculture and industrial pursuits, and to remove for ever the feeling of anxiety as regards their own future and that of their children. The Association recognises that this programme is a bold one, but it thinks it is not visionary; for it says that under its tuition Eurasians and Anglo-Indians will see that they are but a section of the people of India, and that they must live like the people, not by artificial support, such as they have received from a sympathising Government, but by general industry, and in harmony with the circumstances around them. To suit the various tastes or means of the community, a variety of pursuits are mentioned as likely to prove remunerative to an intelligent class of people. Since as is stated by the Association, an extensive grant of fertile land has been secured at a nominal assessment, and as capital is forthcoming, it is thought that almost all the elements of successful colonisation are present.

Some time ago, a memorial was forwarded to the Maharaja of Mysore by the Association, asking, on behalf of the community of mixed European and Indian descent, for a grant of land to enable it to carry out its schemes, which were briefly as follows :—To induce and help the community to till the soil, to acquire a knowledge of various trades, to promote education, to foster intellectual ability, and to further honest and healthy ambition,—in fact, to raise the status of the people, both materially and intellectually, impressing upon their minds the dignity of labour. To promote these objects, it was proposed to form small agricultural settlements, and small plantations for the cultivation of coffee, cinchona, tea, and other products for which the climate and soil of Mysore are favourable. In reply to this memorial, the Maharaja issued an order sanctioning the grant of three different blocks of land, amounting in all to 3,900 acres, bearing an assessment of Rs. 2,764. These blocks were selected by the Secretary of the Association, and they have been reported upon by the Deputy Commissioner, who states that they are unoccupied and available to the Association. The conditions upon which these lands are sanctioned are :—free of assessment for the first two years ; a quarter assessment for the third and fourth years ; half assessment for the two following years, and from the seventh year the full assessment. The grant will be liable to resumption in the event of the Association failing to carry out the object of the concession, which is to encourage agricultural settlements of Eurasians and Anglo-Indians. A further understanding is, that although some encouragement may be needed at the first start, the project, as a permanent institution, must rest upon strictly commercial principles without any special advantages or favours.

Whatever success may be achieved by the Eurasian and Anglo-Indian Association of Southern India, it must be confessed that the movement now sought to be initiated is —provided it is instituted in good faith, and by men who understand not only the requirements of the Eurasians but also their capabilities—an important one, and fully deserving of support. As to whether the Association has over-estimated its own capability we can offer no opinion as we have no other knowledge of its affairs than that we glean from its recently-published guide. Perhaps the view taken by the Association as to the amount of good about to be accomplished is rather too sanguine ; a number of reasons combine to make it so, but that, if the scheme can be worked, even on a less extensive scale than is contemplated by the Association, much good will ensue, no one who has paid attention to the depravity and degradation existing among certain classes of East Indians will doubt. This induces another consideration. We presume that it is just this class that it is intended to benefit, but we would ask—are they, either physically or morally, a class of men who might be expected to succeed in a calling where unremitting labour, hard and often unthankful, is, and will be for some time to come, required before even a bare pittance can be expected ? We trust that the Committee have taken those probabilities into consideration, and fully weighed the possibilities of failure as well as those of success.

As regards the work now about to be entered upon, the Association is of opinion that, although the ryot succeeds, the idea that he is the supreme genius of Indian agriculture is a mistake, for his success is identified with the error of being content with as little as possible. It is believed that the field of agricultural pursuits is still open, and only needs capital, energy, and the introduction of new industries and improved methods to make it give a substantial return. Now, all this is very fine, and the intentions of the Association, as they are put on paper, are doubtless very attractive. But it is not safe to accept, as gospel, everything that is said by the Association in its own behalf. The following passage, for instance, which is published in a Madras paper, and written by a correspondent who has lately visited the Whitefield Colony, is not very flattering evidence of what is really being done. This correspondent says :—'Very little is being done out at the colonies, and, though ' all the land has been allotted, only three individuals have ' commenced work. There are in all five men settled ' down on the spot ; from what I could ascertain none of ' these had commenced work, as they had no huts to lay " their heads in, and the Association refuses all of them " a paltry sum to erect cottages. By the kindness of ' Mr. Marlam, they had all been allowed to live in the hut ' he had erected. If the Association does not afford those " men the little help necessary to erect huts, what is it " going to do with the money obtained from the " lottery ?'

It may be remembered that our Bangalore correspondent, in a letter published on the 13th December, gave evidence to much the same effect. He said that he had been much amused at some of the " laudatory notices of the doings of the Association in some of the up-country papers—notices which have amused me very much, seeing that they appear to have been based on the Association's published reports, which, as a matter of course, give an altogether *couleur de rose* account of the work and prospects of the institution. We, who are nearer the scene of operations, see things going all 'aglee,' and find much more promised on paper than is actually carried out in practice. " Those who have contributed the Rs. 47,000 and odd, " which forms the present capital of the Association, are " not at all satisfied with the manner in which the funds " are being managed; and few will be surprised to learn in " the end that the money has been frittered away on a " number of utterly profitless undertakings."

He furthermore said that the land which had been obtained from the Maharaja of Mysore, for purposes of settlement, was not so fertile, nor likely to be so productive, as the Association would have the public believe. He designated the grant as " not even *kanal* lands, but barren wastes." This is somewhat at variance with the Association's published report. Referring to "Glen Gordon," one of the contemplated settlements, the report says:—"It consists of hill and dale, is well wooded, and has the Pennar running at its base. The land is mostly a rich mould, and portions of it have been under the plough. Iron ore of a very superior quality is found in large quantities, and there are distinct traces of the manufacture of iron here in former days. * * * * * The land is well suited for the following pursuits—Pisciculture, Sericulture, Vanilla-planting, Sheep-farming, Stock-raising, Apiculture, Coffee-growing, Grape-Vine-growing, Fuel-planting, Date-palm culture, Orange and Fruit-tree-growing." The other settlements are alluded to in like terms. Our correspondent says on the other hand :—

In the sketch-map of the colony published in the manual, one sees a diagram representing a number of concentric—and I may say eccentric—circles which purport to bound in sites of cottages for the proposed settlers, and provision is made for the school-house, church, and sundry other structures of the kind, but up to date the only foundation which has been laid is that of a proposed school-house. To people of your side of the Vindhya Mountains, the Eurasian Colony of Southern India is apt to appear an established institution, there being the Association's sketch-map and letter-press description to give outsiders at a distance a general notion of what the colony is to be like, it being easy to allow one's imagination to fill in the details ; but to us on the spot, there is nothing save so many plots of bare land kept waiting for intending tenants who do not evince the slightest disposition to come forward. Those who have applied for lands complain that they have no shelter to go to if they were prepared to take up their settlements, while there is also the fact that the Lottery Committee's promises as to the ploughing, sowing, and building of cottages, &c., in the first instance, have not as yet been fulfilled.

We are not in a position to judge as to the probability of the work of the Association proving a success or otherwise, but considering the gigantic promises and prospects held out to intending settlers in the manual above referred to, we think that the Association owes it to itself to answer its critics. In the preface to the manual, the following passage occurs: "Calculated as we are, therefore, to take a leading part in the destinies of this country, the sooner we make a settlement on the land, the better. There is every hope of our succeeding. If we make a beginning, we may depend upon it we have seen the end of our troubles. We may increase and multiply after that, but all the better. Mother Earth will never play us false."

As we write other considerations occur to us, but we have not the space to devote further notice to the scheme at present, although we may perhaps recur to it on some future occasion. We must say, however, that unless the Association which is "calculated to take a leading part in the destinies of this country" can answer the very serious charges brought against it, the whole institution runs a serious danger of collapse.

AGRICULTURE IN BRITISH BURMAH.

HOWEVER much public opinion condemns the local Government of Burmah for replacing British officers in the Commission by Burmese, who are not at present so fitted for the performance of the responsible public duties with which they are entrusted, and to the favour shown to Burmese over other classes in minor police and other Government appointments, there can be no question but that the present Chief Commissioner of the province has his heart in his work, and is doing wonders in stimulating the lethargic Burman, so that he may not be altogether replaced in his own country by more active and energetic races. The new Department of Agriculture under Mr. Smeaton is awakening the people to the advantages to be derived from having a dry-weather crop on their fields, from which Burmans have hitherto been only accustomed to get their annual crop of paddy. The fertility of these paddy-fields has made Burmah the great rice granary of the world; but with a little extra labour, and irrigation, and manure, in some places, the Burmese agriculturists might obtain about double their present income from their lands. The wheat of Burmah is said to yield more flour than Indian wheat, and a bushel of it sells for about two and-a-half times the ordinary price of unhusked rice. Yet wheat for British Burmah is mostly imported from Upper Burmah and India, although large parts of the Prome and Thayetmyo districts are as fit for its cultivation as any part of Upper Burmah. Its cultivation in British Burmah would largely develope the resources of the province, and might be carried on in the dry weather when the paddy-fields are left fallow. Tobacco, again, is grown in 12 out of 17 districts yet little over 13,000 acres is the whole cultivated tobacco area, of which nearly one-fourth is in Thayetmyo alone. In Burmah almost every man, woman, and child smokes, so it is hardly surprising to find that nearly 16 millions of pounds of tobacco have to be imported annually into this British province, where climate and soil seem admirably adapted for tobacco cultivation and manufacture. Mr. Bernard wishes to start a tobacco factory where a Virginian tobacco planter will purchase all leaf brought for sale, just as paddy is bought by the merchants now, for cash on delivery, and where the curing, in which the Burmese are not adepts, would be conducted on proper scientific principles. The establishment of such a factory would, it is thought, induce numbers of the people to engage in tobacco cultivation; waste land would be brought under the plough, a new industry would be started which would not only supply the local demand, but create a new export staple for British Burmah. Sugar-cane thrives luxuriously in all parts of the province, and in some parts the land is not even ploughed before planting. In many cases, no artificial irrigation takes place, and the only manure applied is the ash of the grass and jungle burnt over the land in the month of April just before the rains. Little care is bestowed in weeding, the plants being left pretty much to themselves. In twelve months a crop of cane is produced with a sugar-bearing quality superior to most Indian cane. The local demand is so high that, although in the past five years there has been a yearly increase of cultivation of from 3 to 22 per cent., over 11,000 tons of sugar have to be imported by sea for the Burman market. The high prices obtained by the people for their rice during the past ten or twelve years have no doubt enabled them to purchase imported tobacco and sugar without difficulty, but now that the rice market has fallen to normal rates, and the Agricultural Department is showing Burmese agriculturists what sources of wealth they are neglecting, it is to be hoped the Burmese people will soon be in a position not only to supply all local demands with sugar and tobacco, but to export their surplus crops to countries not blessed with such favorable soil or climate for the production of those articles. Jute, again, is found growing wild all over the province, yet no attempt is made to cultivate it by the people, and although the fibre is said to be soft, glossy, and strong, Burmah imported last year from Calcutta jute bags to the extent of £325,351. Supplies of seed were obtained from Bengal last year, and small areas have been selected for experimental cultivation. Mr. Bernard thinks that the labour necessary for separation of the fibre will be a stumbling block to the Burman cultivator, but he hopes this difficulty will be surmounted; and that looking to the enormously developed rice trade of the province, and the consequent demand for jute gunny bags in Burmah where both soil and climate are suitable for the successful growth of the raw material, it is of the highest importance to give the people every inducement to grow the plant as a field crop, as in Bengal, in addition to their paddy.

Although the recent alarming increase in dacoity and violent crime in Rangoon and the Hanthawaddy district is not creditable to the administration, and, according to local opinion, may be directly traced to the reduction in the European staff and the promotion of Burmans not properly qualified in their places, the exertions made to point out to improvident agriculturists the opportunities they are neglecting, and the sources of wealth and independence which are lying open to them, if they will only exert themselves and utilize this magnificent soil and climate all the year round, is worthy of all praise. We trust, before another couple of years are over, to find that the exertions of the Chief Commissioner and his Secretary in the Agricultural Department are crowned with success. When education, wealth, and their attendant, civilisation, have increased to the extent they are likely to do in another decade, the Burmese race will be more fit for the appointments and promotions recently made than they seem to be at present, and no Englishman who knows anything of the province would wish that they should be denied their share of the official "loaves and fishes," when they have proved their capabilities for the higher grades of the public service.

AGRICULTURAL BANKS.

IN the *N.-W. P. Gazette* of the 2nd December 1882 appears an Official Paper on the "Agricultural Loans Bill" of 11th November preceding. This paper contains the Council speeches of the Hon'ble Major Baring and Sir Stewart Bayley on the subject. The Agricultural Loans Bill is meant to supersede the Land Improvement Acts of the past, by promoting the establishment of *private* Agricultural Banks. These Banks are to advance loans to the agriculturist at rates to be officially fixed (according to local conditions and individual cases apparently) and not to exceed 12 per cent. per annum. The Banks are to keep their accounts in a form *officially* prescribed, and subject to *official* audit. Loans are to be granted under *official* sanction for—

(1) the construction, maintenance, and repair of wells, tanks, and other irrigation works ·

(2) the drainage, and reclamation of land from rivers, swamps, &c.;

(3) the conversion of waste into culturable land.

The Government undertake to recover for the Banks from the principal and sureties all such loans as if they were "arrears of land revenue," and where collateral security exists in the shape of *immovable* property, by the sale of the latter also, as when "arrears of revenue" are realised; prior rights and interests in the land mortgaged not being prejudicially affected.

Sir S. Bayley shews that the agriculturist borrows from the village usurer for other purposes than "agricultural improvements,"

to which the loans of the proposed Banks are to be restricted. Notably for marriages. But details of his miscellaneous (and to him by far the more urgent and constant, if not the more important) requirements, are necessary here, namely, advances for—

(1) the Government half-yearly demand ; land or water, or both;

(2) purchase of cattle, milch and draught ;

(3) agricultural implements ;

(4) gold or silver ornaments for the family ;

(5) marriage, birth, and mortuary expenses in variety ;

(6) pilgrimages, bathings, brahmin feasts, and propitiatory and sin-offerings to local deities ;

(7) miscellaneous expenses, down to the *newta* or reciprocal marriage contribution.

The proposed Agricultural Bill ignores all these, and provides strictly for "land improvement" only. Sir S. Bayley correctly holds that the agriculturist who mortgages his property to an Agricultural Bank for this solitary purpose, will certainly be repelled by the village usurer when subsequently applying to him (as he must) for his other requirements, because he will have no security to offer. The agriculturist must, therefore, discard the Bank with all its temptations of low rates of interest and strict honesty in accounts. He will find further, in the non-rigorous demand of the village usurer, an additional reason for preferentially dealing with him. Still more (and this is overlooked by the able Member) the agriculturist need not mortgage *anything* to the village usurer. Acute indebtedness is not chronic everywhere, although through the adverse circumstances of Indian agriculture (which is not farming, but tilling the soil) the agriculturist must frequently and often continuously borrow for his professional and private needs. Thousands of loans are granted without mortgage of immoveable property. Thousands and thousands of transactions occur annually in the N.-W. P. (and elsewhere, too, I should presume), in which loans are advanced to the village *proprietary* of *all* grades, and to the equally numerous *tenantry* too, *without any security whatever*. It is when debts, too often expanded by falsification of accounts, are not paid, or not attempted to be paid, that the village usurer closes his money-bags, and refuses to grant any further loans unless land or house, ornaments or cattle, are mortgaged. The impunity for fraud which the illiteracy of the agriculturist affords makes the latter, however, a helpless victim more or less *always*. In time, of course, in the case of the thoughtless, imprudent, unwary or unfortunate, decrees with their lamentable consequences follow. Is it likely, however, even in view of all this, that, when an agriculturist, solvent or insolvent, can borrow on a running account, squared or consolidated half-yearly or yearly, without deed or mortgage or lien or pledge, and satisfy all his requirements locally and speedily, that he will trouble himself with deeds, &c., and with delay and harassment under journeyings to and fro to a distance, his trouble all likely wasted and his position rendered the worse, through the discovery and consequent widespread publicity of possible insolvency, in order to get a loan from an Agricultural Bank, simply for *land* improvement? It cannot fail to precipitate the usurer's action against him, and probably against all others suspected of similar effort. It is true that Major Baring proposes, inferentially, to meet the contingency by putting the Agricultural Bank in the position of *first* mortgagee. But this would not meet the derangement of the inter-relations between agriculturist and village usurer whether mortgagee or not, and it is not by any means certain that the agriculturist would be a consenting party to the transfer of the position of a *first* mortgagee Whence, after all, is he to get advances for his multifarious needs? Not from the Bank, clearly. Still less from the local Shylock. The securities are all locked up by the Bank. In fact, the much-abused village usurer, infamous as he frequently is, constitutes a most important and essential factor in the social and political economy of the country.

If it is *seriously* sought to assist the agriculturist at all, *it should be thoroughly and in absolute supersession of the village usurer.* That the agriculturist needs State aid, is becoming an uncomfortable political fact. The Government exhibit uneasiness on the subject. That some counterpoise to the exactions of the village usurer should be established, is, in the condition to which matters are everywhere assuredly gravitating, a growing social necessity. The Government appear solicitous to devise some measure to that end. But that Agricultural Banks, with restrictions on their operations in terms of the Bill at present before the Council, will afford any relief to *the mass of the ever-increasing village proprietary* who constitute the back-bone of the country, is palpably unlikely. The proprietor of hundreds or thousands of acres will doubtless benefit, but his benefit will rarely be any benefit to the country.

To be a counterpoise to the village usurer, the proposed Banks should keep a *running account with the village proprietary*, just as the village usurer does. It might be objected that the proposal is beyond the scope of official intentions and *official* possibilities. I am not quite sure of impossibilities. As respects the former, the relief of large land-owners by specific measures like the proposed Agricultural Banks is a mistake, when *any* Bank anywhere will advance loans on their substantial property. Extravagance and incompetence cannot be permanently relieved by the reduction of interest on loans by 6, 12, or even 24 per cent. But any such reduction to the mass of the village proprietary will be appreciable, coupled as it will be with emancipation from the frauds of the village usurer. Against the latter the large landholder is tolerably secure. He has those about him who guard his interests,—at any rate, when they do not combine to plunder him. In such case, however, the proposed relief to him is useless, for the State offers him in the projected Banks protection from the local usurer, not from his advisers and environments.

The following scheme of Agricultural Banks for the mass of the agricultural community, rich and poor, comprising substantially the operations of the village usurer (divested, however, of all his forms of exaction) with the features of the Banks contemplated by Government, will likely possess some points of attraction to official consideration.

Some 12 years ago, as administrator, I had to release an estate from suretyship for a mercantile firm to a bank. I had reason to demand and obtain from the Bank a full statement of the firm's account from date of suretyship. The loan for which the deceased had stood security was, what is termed a "Floating Cash Credit"—by which is meant *a running account with a stipulated maximum of indebtedness.* Suppose Rs. 10,000 is the credit arranged for. The borrower draws it out at once or what he needs, repaying sums to account at intervals, and drawing out others, the bank *not permitting the* Rs. 10,000 (including interest) *to be ever exceeded.* When no payments in reduction of debt for six months, such as would comprise interest due and some of the principal, are made, the Bank addresses the borrower and his sureties. *These* might be with or without collateral security. Failing to ensure an appropriate instalment, the Bank exercises the right of closing the transaction and recovering the debt by action at law against sureties or principal. This is seldom a necessity. It is neither to the advantage of the Bank, nor to the constituent, to close an account. What is the purpose of banking but to have money out at secure interest? As long then as interest and a fair portion of the principal are restored at due intervals, the see-sawing "give and take" of the "Floating Cash Account" goes on, to the satisfaction, convenience, and profit of *all* concerned. Interest is calculated nominally at 12 per cent. per annum, but manipulated by mutual (!) consent in a particular way, amounts to something appreciably more. The *surety or sureties with or without collateral security are necessarily fixtures, while the account runs on probably for indefinite years.* The account is terminable only by the borrower discharging the debt.

I propose to apply this "Floating Credit" system with its indefinite periods and its, to all intents, permanently-fixed sureties to Agricultural Banks, as pre-eminently adapted to the exigencies of the Indian agriculturist—but of course without the form and extent of interest. *That should never exceed 9 per cent., because of the ample security furnished.* It should be calculated on each fractional sum withdrawn and debited at the end of the half-yearly harvests or *fasls.* These will of course vary with locality. The rate of interest should be graduated to a scale of property. The owner of 100 acres and below should be charged 6 per cent.; 100 to 500 acres, 7 per cent; 500 to 1,000 acres, 8 per cent.; 1,000 and upwards, 9 per cent. The borrower should mortgage immovable property, stock notes, currency notes, promissory notes, whatever he prefers, or whichever he possesses; or where already mortgaged, the Bank should, if practicable, become first mortgagee by purchase. The exemptions from mortgage should be the agriculturists' cattle (milch and draught), his implements, household goods, and metal ornaments. The mortgage should entail no charges or costs whatever—as stamps, fees, &c. It should be nominal in form but substantial in effect. It will be sufficient to devise a form of application for a "Floating Cash Credit," to which should be attached (or by endorsement on back by the village putwarie and 2 lumberdars or headmen) a detail of the property owned and offered by the applicant—income or rental, prior mortgage on any of the effects or not, who the mortgagee, what the amount, &c., &c. *These details are sure to be locally known.* A mortgage is not concealable, because registered at the

Tehsil—and the detail of fields and houses is part of the village records, copies of which are annually forwarded to the Sudder Station. With the cash debts of the applicant, the Bank should not trouble itself. These would be difficult to discover and would serve no practical purpose. They should not be held to interfere with the Bank's operations, or affect them in any way.

The application and its annexure being forwarded by the Bank to the Collector of the district, he will transmit the same to the Tehsildar for verification. On return to him, the Collector will sanction the amount of the "Floating Cash Credit" to the extent of verification. He will also fix the interest, and the Bank will advance accordingly. This will complete the transaction. If the applicant can give a surety or two with or without collateral security, it will perhaps be often acceptable—but with his immoveable property mortgaged, *there should not be any absolute necessity for rigorous conditions.* When the sureties, however, are as substantial as the property mortgaged, the amount of the credit might be enhanced. The other conditions that will regulate the amount of credit will of course be the marketable value of the property mortgaged; or the actuarial value of its rental, or of the income from it. How much below the valuation should be advanced, must be determined according to the possible depreciation of the property pledged. 15 per cent. will likely be found sufficient or more than sufficient in many cases where house property is concerned. Of course, where the position of *first* mortgagee has to be purchased, such outlay will form part of the advance or "Floating Cash Credit." The borrower will then be free to draw up to the amount of his credit, *for whatever purpose needed by him,* and in whatever sum he decides on. He will be charged interest on each sums *from the date of its withdrawal,* not on the entire sum placed at his disposal; and he can repay from time to time or half-yearly the sums stipulated on, still withdrawing amounts all over the year as needed by him. *In fact, just as he would with the village usurer,* barring the provident limitation of indebtedness, which is entirely in his own interests.

The transition to the new condition of things will therefore be generally in *consonance with the agriculturist's feelings and his habitual mode of doing business*—and he would find compensation for restriction in debt, in the lower rate of interest and perfect honesty in accounts. In the event of the credit being exceeded by accruing interest (it should not be allowed to do so by overdrawals except at the Bank's own risk) or when stipulated half-yearly amounts are not paid, the Government, if failing by notice of action to the debtor to ensure any reduction of debt to an extent, say *one-third* below the credit, can proceed to recover from principal and surety as if for "arrears of land revenue"; leaving however the debtor free to meet the said limited demand *plus* costs at any stage of the proceedings against him and *keep his account running.* Provided that once the debtor paid up in full, the transaction should terminate. A fresh account could however be started in the prescribed form.

It might be urged that the debtor would sell his movable possessions to the village usurer on exhausting his floating cash credit at the Bank. He might do many things. If a man determines to drown he will certainly do so. But that is neither here nor there. The suggestion, however, is legitimate that what he is likely to do in a spell of improvident infatuation, or misfortune with his *movable* goods, he certainly should not be permitted to do with his *immovable* property pledged to the Bank. In short, *no one should be allowed to assume the position of second mortgagee by advancing money on such property.* He should have no remedy at law, nor any cash credit, against the property mortgaged. This might be held very exceptional procedure, and we might be treated to lengthy sermons on what Carlyle mistermed "that most dismal science," political economy, but the case too is exceptional; and if the agriculturist is to be saved from ruin at all, legislation must take the course indicated.

And what is there peculiar after all in this? The borrower must be a consenting party to the arrangement before it can be carried out. It is not compulsory on him to borrow at 6 to 9 per cent at the Bank, if he prefers to borrow at 18 to 36 and 72 per cent elsewhere. He is simply told at the outset that he cannot be accommodated up to 9 per cent, unless he agrees to certain conditions strikingly in their incidence to anything of the sort elsewhere, *because thoughtfully and conscientiously framed entirely in his own interests.* He is a free agent. Acceptance by him of the conditions offered cannot be construed helplessness, unless a new and novel signification be given to the term. A few years' apprenticeship to the art and practice of economy will do him appreciable good—and the succeeding generation will presumedly compare favourably in thrift with the present.

The objection that the agriculturist would by the "Floating Cash Credit" system remain permanently entangled with the Bank, as many are and he once was with the village usurer, would hold good only if he were improvident or had suffered agricultural and other losses; *and* if he at the same time wished to be free of the Bank. But a reduction of interest up to 24 per cent and the conviction of honestly kept accounts would make even the *provident* and solvent Agriculturist desire to keep his "Floating Cash Credit" always open, if even at a reduced figure, so that he might satisfy his requirements over the year without trouble.

Honestly-kept accounts should of course distinguish the transactions of an agricultural Bank under private management. But what if the impunity which has created the village usurer should affect the Bank too? Safeguards feasible on paper might prove fanciful. Mere accessibility of books to official examination and audit would yield no protection to the agriculturist. Is efficient official knowledge in respect to the payment of sums, or the sums repaid, possible? Sanction for the withdrawal of every sum would not suit the borrower's convenience. It would involve endless trouble all round. What is the testimony beyond a receipt for the actual amounts paid in by an illiterate man, if the receipt proved doubtful? The transfer of the Bank to a Sudder Station for the purpose of efficient official supervision would, by reason of distance from the outlying sub-districts, make the agriculturist resort to the village usurer as of old. The suggestion is that *Banks should be local to every sub-district, and should be officially initiated and managed,* but not by the agency of the sub-district executive. If a *private* Bank is held able to do a profitable business, which it would, on the terms officially provided, so an *official* Bank with a paid agency. The already burthened district executive should be spared banker's work. Can the State afford so much capital? Certainly not, if Banks are to be started at once in every sub-district throughout the country. But a commencement can be made in some Sudder Stations, and in some outlying sub-districts, wherever people of capital and property, *who are also local residents,* can be found to take up official agencies under the qualification of suitable security. As time would be required to extend the Banks over the country, the village usurer would have leisure to re-consider his position, reform his distorted views of honesty, and abate his exactions, if he wished to retain his hold on his constituents. He would certainly so wish; and, so wishing, would act accordingly —probably not to the extent of loose anticipation, but there would be sensible reform to the benefit of the agriculturist. An indirect result of establishing Agricultural Banks, it would be a welcome precursor of the Banks themselves.

To prevent the execution of decrees, let the *Government at once step in and buy up decrees* by notification, and at a fair valuation. These would furnish in every district the nuclei of the proposed Banks, and would serve pre-eminently as advertisements of the *Sirkar's* project for benefiting the agriculturist, not to be misunderstood, or distrusted by, or misrepresented to, him. The Government might indeed for a time confine itself to buying up decrees until its object and purposes were placed beyond misunderstanding by the "Floating Cash Credit" it would introduce through them. Banks could then be developed from the basis thus established.

In time the Government would feel its way to the transfer of these Banks in the rotation of initiation, or as circumstances rendered advisable, to private agency, with the necessary safeguards in the agriculturists' interests. Not the least among them would be the *personnel* of the Bank *employés.* These should be always *local residents of property* and capital as employed by Government in initiating the Banks. These very *employés* might take over the Banks, instead of their falling into the hands of mere speculators from a distance little in unison or sympathy, if at all, with the agriculturist. The case is not one of ordinary dealing between capitalist and constituent, but vast and important interests are involved. The agriculturist is the financial backbone and mainstay of the country, and it cannot assuredly ever be the purpose to call in capitalists and speculators from a distance, even if bound down with large penalties for misconduct, to make over to them an El Dorado exploited officially with anxious thought and care. There are no parallel conditions anywhere. India is an agricultural country, and State protection of the interests of the agriculturist is a paramount, and to all likelihood, a permanent necessity.

If an Agricultural Bank when transferred to (local) capitalists may grant ordinary loans bearing interest, *i. e.,* other than "Floating Cash Credits," the Government should in no way be responsible for them. The transaction should not be sanctioned, and the Bank should be warned that any rate of interest beyond that which would be charged in the same case on a "Floating

Cash Credit," will not be recoverable at law. This rule shuld be part of legislation in the matter. For it is clear that *any tendency in an Agricultural Bank to gravitate to the position and developing practices of the present village usurer* is to be carefully checked. The Agricultural Bank is for the purpose of superseding the village usurer, affording the agriculturist a cheap *running credit* to a certain amount, and emancipating him from the usurer's exactions. This purpose, *not that of getting hold of the agriculturist's property*, is to be kept in view. A lump sum is soon spent, usually misspent; and the ultimate consequence of following embarrassment, is a decree. Indeed it might prove on consideration an important necessity, that *Banks should not travel out of the functions and scope officially assigned to them—viz.*, to afford "Floating Cash Credit" to the agriculturist.

It might be urged that the *tenant* unfortunately cannot in the above scheme share with the *proprietor* the advantages and benefits of such credit. He has no immovable property to mortgage except some wretched mud and straw tenements. His crops are hypothecated to the proprietor responsible for the Government demand. It cannot, however, be charged as a demerit to a scheme that endeavours to effect so much, that it is not so searching as to reach the *tenant*. No measure can be framed such as will supersede the principle of the commercial formula, "No security, no credit." Nevertheless, the field of suggestion is not closed here. It does not follow that security is not valuable unless in the form of mortgage, lien, or person. *The borrower's good faith and industry are abundant security*: are, and have been so held for untold years by the village usurer dealing with *tenantry* throughout the country here. Can it be otherwise elsewhere? If so, how are rents paid to the proprietary? Tenants, as a matter of course, possess no land unless they are inferior proprietors cultivating the land of richer ones. They have only the usual mud tenement, milch and draught cattle, and (the better sort) some metal ornaments. Not always are these pawned or sold. The tenant borrows from the usurer, the latter satisfying himself as to the extent of credit he should give: the standing hypothecated crops, a buffalo or two, and a pair of bullocks are viewed and approved. When the crops are garnered, the usurer comes round and receives the whole or such part as the tenant decides to pay to account. With an abundant harvest and high prices, the usurer is cleared off, or if his claim is not satisfied to a certain extent, a heifer or the old buffalo itself, or *the* pair of bullocks (to be replaced by stronger and younger ones) are ultimately made over to him, most likely at a reduced valuation. But satisfaction of claim partially or wholly is rarely *not* followed by the usurer's readiness to lend again. As pithily expressed in Bunneah phrase—

Jo manga so deea,
Jo deea so leea;

or literally—

Gave what was wanted,
Recovered what was due.

At times the tenant, like the small proprietor, gets very much involved. A series of bad harvests, or low prices, or both, are possible calamities. Illness at critical agricultural periods prevents opportune ploughing, irrigation or sowing, and appreciably affects outturn. In such cases the usurer's claim is postponed. Like the tenant he hopes for a better ensuing harvest. If disappointed, or the tenant proves dishonest (the dishonesty of misery) the usurer proceeds to sit in *dhurna* on the tenant. A composition is eventually arrived at, unless the tenant has previously disposed of his assets. A law-suit is objectionable, for its outlay, delay, and uncertainty. The poverty of the tenant, simulated or real, and the facility with which discovered movable effects vanish, furnish little to proceed against. Threats followed by the flourish of stamp paper do not always end in a law-suit. The collective sense of the community, proprietary and all, is against Shylock, and witnesses will likely be wanting. The general feeling is that he has been served rightly and does not deserve any more payments. He consoles himself by piling on compound interest, and duns the tenant indefinitely. All considered, he is no loser, but he is happy in the misery of a fancied grievance. He nurses it and hands it down to his children, and they hopelessly dun the cultivator's children. How then does a tenant with lost credit find accommodation? In truth he has no difficulty in replacing his *sah* or banker. He is always a fat constituent. Loans at 24 per cent and upwards, and a few frauds, leave an ample margin to the usurer for losses, so called.

At first sight no Agricultural Bank could compete with the village usurer for the custom of the *tenant*. The risk appears too great. Nor could the Government recover debts as if they were "arrears of land revenue." His crops are hypothecated to the landlord, and his movable effects vanish rapidly in prospect of danger. The difficulties appear insurmountable. But with Agricultural Banks accomplished facts, *a system of small "Floating Cash Credits" on the security of two or more of the proprietary*, would be feasible, and prove a boon to a hard-working body mercilessly fleeced by the village usurer. Debts could be officially recovered from the sureties as if "arrears of land revenue."

To conclude. If an experimental Agricultural Bank of any sort is a necessity in the Deccan for the hopelessly indebted agriculturist there, even more cogent reasons require the establishment of such banks in localities in which like agricultural insolvency has not been reached. It is far better to step in and prevent calamity than to grapple with the impossible as (by all accounts) in the Poorundur talook in the Deccan. Bad for the interests and principles at stake, if the Deccan experiment is a test case for the extension of action elsewhere, for it assuredly means *failure*. There is a world of potency in initial success. I would therefore strongly recommend the trial of Agricultural Banks on the lines laid down in these pages, among the Jat agriculturists of the Ganges and the two Jumna canals, and in other provinces under like conditions of success.

A. P. W.

BAROUT, MEERUT DISTRICT;
30th December, 1882.

EDITORIAL NOTES.

A RESOLUTION in the last *Gazette of India* deals with the question of issuing duty-free salt for use in the manufacture of soap. There is no difference of opinion as to the desirability of relieving the industry of this burden. The question is how this can be done without danger to the revenue. The various provincial Governments have been consulted on the subject, and they are all more or less favourable to the attempt being made under certain suggested restrictions. As there is some difference of opinion among them as to these restrictions, the Government of India, instead of laying down any general rules, has determined to leave each Local Government to make its own arrangements, subject to the final decision of the Supreme Government, to whom they must be reported. "It must be understood that the manufacturer is to bear any extra cost for preventive establishments, &c., which the grant of the concession may necessitate, and that the privilege is liable to be withdrawn if experience shows that it is being abused, or that the revenue is suffering."

WE learn from the report on the cotton production and trade of the North-Western Provinces and Oudh for the year 1881-82 that the season was, on the whole, a very favourable one, and, that the outturn was greater than that of the preceding year. The total area under cotton during the year under report was 16,37,364 acres, as against 12,70,121 in 1879-80, and 14,19,042 in 1880-81. Of the total of 16,37,364 acres, 3,88,650 acres was land richly manured, 6,27,667 land ordinarily manured, and 6,21,847 was poor land. The average ruling prices of cotton retained for local consumption was lower than in the preceding year, as will be seen from the following table:—

	PRICES PER MAUND (OF 82lbs.) COTTON.		
	1881-82.		
	First quality.	Second quality.	Third quality.
	R. A. P.	R. A. P.	R. A. P.
For North-Western Provinces districts ..	15 15 4	15 3 0	13 11 7
For Oudh districts	16 14 6	15 11 9	14 12 0
	1880-81.		
	R. A. P.	R. A. P.	R. A. P.
For North-Western Provinces districts ..	17 14 6	17 0 10	15 3 6
For Oudh districts	18 10 11	17 4 7	16 3 7

The average ruling prices realised for cotton exported were also lower than in the year previous.

The total estimated value of the cotton crop for the North-Western Provinces and Oudh is put down at Rs. 2,19,48,462-3-5, made up as follows:—North-Western Provinces, Rs. 2,15,69,826-14-8; Oudh, Rs. 3,78,635-4-9. The gross exports of 1881-82 were 13,45,249 maunds, valued at Rs. 2,01,02,798, as against 11,97,920 maunds, valued at Rs. 1,82,97,980 in 1880-81. Of the total exports, 9,02,562 maunds were consigned to Calcutta. Of this amount Agra contributed 3,08,967 maunds, and Cawnpore 4,20,783 maunds, the balance being contributed by other districts.

From experiments made at the Cawnpore Experimental Farm in the cultivation of Hingunghat cotton and of the varieties of American cotton known as New Orleans and Upland Georgian, on two classes of soil, light loam and a heavier loam, against two varieties of country cotton, it would appear that for light poor soils the indigenous cotton is by far the most profitable, and that on better class soils and with careful cultivation New Orleans cotton can be grown with success and profit.

THE resolution on the forthcoming International Exhibition to be held in Calcutta has been published. The Lieutenant-Governor of Bengal considers that the project, launched by Mr. Jules Joubert, is likely to have a very important effect in developing and promoting the commercial prosperity of India, and he has therefore accorded his sanction and support to the undertaking. The recent Exhibitions in Australia and other Colonies succeeded in giving commerce an impetus, and a like result is anticipated for Indian trade, when the attention of foreign countries is drawn to the great natural wealth of this country; and as the co-operation of Local Governments and Administrations has been invited by the Government of India, there is every reason to believe that the collection of Indian articles will be as complete as possible. Mr. Jules Joubert is an experienced man in such undertakings, and no doubt exists as to his ability to bring the undertaking in India to a successful issue. The 4th of December next is the date fixed for the opening of the Exhibition, and both a general and an executive committee for Bengal have been nominated.

The exhibits will be divided into ten sections, as follows:—(1) Fine Arts; (2) Education and application of liberal arts; (3) Health; (4) Furniture, and other objects for the use and decoration of dwelling-houses and other buildings; (5) Fabrics, including apparel, toilet requisites, and other objects of personal wear or use; (6) Raw products, and manufactures from products not included in other sections; (7) Machinery and implements; means of transport; appliances and processes used in the common arts and industries, including models and designs; (8) Food products; (9) Agriculture and horticulture; (10) Ethnology, archæology, and natural history. Every facility will be afforded to exhibitors and their agents, in connection with the transport, display, sale, and care of their exhibits, and the utmost precautions will be taken to preserve exhibits from injury, and to guard the buildings; but no responsibility will be undertaken for damage or loss; and exhibitors must make their own arrangement for effecting assurances. Arrangements, with reference to machinery in motion, will form the subject of special regulation. Concerning the arrangements with regard to space, it is announced that the ordinary charge will be two shillings for each of the first 20 square feet, and one shilling for each additional square foot. Exhibitors desiring a frontage to any main avenue for their cases, can obtain it on payment of an additional five shillings per foot of such frontage, irrespective of depth. The general reception of articles will commence on or before 1st October, and will cease one week before the opening. A special jury is to be appointed for the award of gold, silver, or bronze medals or certificates. The Exhibition will be kept open until about the 1st of March 1884. It will be held, as we announced some time ago, partly in the Indian Museum, of which a portion will be set free for the purpose, and partly in buildings annexed to the Museum. These annexes will be commenced immediately by the Public Works Department.

THE honorary secretary of the Calcutta Tea Syndicate has issued a circular, reminding those members who propose to send samples of tea to the forthcoming Amsterdam International Exhibition, that the latest date now fixed for the reception of samples of the new season's teas is the 4th of February, after which date none can be received. The Committee are now able to state that Mr. Luther Hart, of the firm of Messrs. Hart and Sibthorp, tea brokers of this city, has been appointed to represent the Syndicate at the Exhibition, and also to travel for the purpose of investigating the Russian, French, and other European markets, with a view to encouraging trade in Indian tea, and obtaining the fullest particulars with regard to these markets for the information of the Syndicate.

Attention is called to the notification made in the memorandum recently issued by the Revenue and Agricultural Department, in conjunction with the Tea Syndicate. It is there stated that samples of new season tea may be despatched by parcel post, addressed to the agent of the Tea Syndicate, Amsterdam Exhibition, by any exhibitor who has sent an original consignment. These teas will be substituted, at the exhibitor's request, for those in the bottles previously despatched, but it must be clearly understood that those who have not originally sent samples through the Tea Syndicate cannot be allowed this concession. Samples of new teas must reach Amsterdam not later than 30th June, and measures will be taken by the Government to postpone, if possible, the adjudication of awards for tea until after that date.

The committee will be very glad if a few half-chests of tea can be presented to the Syndicate for distribution in small packets at the Exhibition, and for consumption in the Syndicate allotment of the Indian Court.

THE annual returns of cotton production and trade in the Central Provinces for the year 1881-82, show that there has been a gradual decrease in cotton cultivation in those provinces during the last three years. The total area under cultivation during the year under report was 666,031 acres, as against 756,136 in 1879-80, and 682,962 in 1880-81. The season was very unfavourable for cotton production. In the Chanda, Saugor, Damoh, Chindwara, and Nimar districts, the crop is reported to have been good and well up to the average; but in the districts of the Nerbudda Valley and in the Nagpore and Chuttisghur plains, it is said to have suffered very great damage from the heavy and continuous rains.

The conclusion which it appears to the local Administration may be derived from the fact of the yearly decrease in cotton cultivation, is that cotton would seem to be giving place to cereals in the agriculture of these provinces. It is said that, with the exception of the Wurdha, Chanda, and Nagpore districts, no other part of these provinces is peculiarly fitted for the production of cotton, and it has been reported from some districts that cotton cultivation is giving place to that of wheat and other food grains, now that cotton can be imported at a lower price than formerly ruled for it.

The total outturn of cleaned cotton during the year under notice was 173,328 cwts., and the average outturn per acre was 51lbs. These figures are higher than those of 1879-80, when the total outturn was 165,760 cwts., and the average per acre 24lbs., but much lower than those of the year immediately preceding, when the outturn amounted to 262,480 cwts., with an average of 50lbs. per acre. The highest outturn obtained was in the Wurdha district, where it amounted to 41,847 cwts., and the Saugor district came next with an outturn of 30,141 cwts. In the Nagpore, Jubbulpore, Chindwara, Nursingpore, and Nimar districts, the outturn aggregated 69,095 cwts. Elsewhere in the provinces the outturn was more or less insignificant.

The average ruling prices of cotton retained for local consumption ranged from Rs. 15 per cwt. in the Saugor district to Rs. 32 per cwt. in the Sumbulpore district, while the average prices realised for cotton exported was from Rs. 15 per cwt. in the Saugor district to Rs. 28 per cwt. in the Sumbulpore and Bilaspore districts.

The total estimated value of the outturn of crop was Rs. 39,84,263 as against Rs. 42,81,710 in 1879-80, and Rs. 63,44,300 in 1880-81. As the season was a very unfavorable one for cultivation, the great decrease in the value of the crop may be easily accounted for. There has also, we observe, been a large decrease in the total quantity of cotton exported from the provinces during the year 1881-82,

when compared with the exports of the two preceding years. During the years 1879-80 and 1880-81, the exports amounted to 104,342 cwts. and 174,639 cwts., respectively, while during the year under report the quantity exported was only 94,151 cwts. Of this, 79,305 cwts. went to Bombay and the Berars; 12,444 cwts. to the North-Western Provinces and Bengal; 1,935 cwts. to Cuttack and the Eastern Coast, and 467 cwts. to the Central India States. The shares per cent in the total exports of the last three years taken by each of these places were as follow :—

	Share per cent.		
	1879-80.	*1880-81.*	*1881-82.*
Bombay	51	16	84·5
N.-W. P. and Bengal	46·5	85	13
Central India	0·5	3	0·5
Cuttack and East Coast	2	1	2

The *Planters' Gazette* says :—"Amongst the articles of export enumerated in a recent report from Kiung-chow is one under the name of Kêuch'a. This is described as a preparation for adulterating tea. The name Kêuch'a, meaning root-tea, is an abbreviation of Lâ-te-shêug-rëu, or *Bryophyllum calicinum*, the Chinese term, which implies that the leaf when it falls develops a root, being intended seemingly as descriptive of the charactertistic manner in which this plant can be propagated. It grows abundantly on roadsides and waste places in the neighbourhood of Kiung-chow, and its thick and fleshy leaves are gathered all the year round. These are cut into strips, and the pieces exposed to the sun for several days, when, being still slightly moist, they are rolled up by hand so as to resemble tea, and after being completely dried, are ready for exportation. It is satisfactory to know that the export of this spurious tea, which is said to go mostly to Macao, is but a small one, the total in 1880 having been 180,939 piculs, valued at 1,143 taels.

A trial has, it seems, been made of a new machine, patented by Messrs. Death and Ellwood, for extracting fibres, and we understand that it has proved thoroughly successful. The novel feature in it is that the dirt is washed and winnowod from the fibre as it passes through the machine by a jet of water and a fan, and so, by a single process, the fibre comes out clean and ready for use. It has been tried upon aloe leaves, plaintain stems, and hemp, and has, we are told, succeeded with all, but especially with the two former. We may mention that it is of small compass, and costs less than £40.

From statistics which have just been compiled, it appears that the production and export of wheat on a great scale is a comparatively new business in the United States. About forty years ago, a considerable quantity was imported from Europe, and in the five fiscal years ending June 1840, the exports were only 1,842,841 bushels. By 1880, however, the aggregate exports had risen to 153,252,725 bushels; the exports of flour for the five fiscal years ending in 1825 amounted to 4,451,384 barrels, or 99·61 per cent of the total of wheat and flour exported. The percentage of flour steadily decreased from that period till 1880, when it was only 15·2 of the whole. Last year it once more rose. Mr. Edmonds, who compiled these statistics, is of opinion that the proportion of flour exported will steadily increase in the future, owing to the popularity of the American article, and the necessity of finding a foreign market for the growing output of the mills. The history of corn in the United States dates from the year 1611, when 30 acres were planted by the James River settlers. Now the fields amount to 62,000,000 acres, yielding 1,500,000,000 bushels and upwards annually. The exports of corn, compared with the whole crop, are small, but a great deal goes out in the form of meals. The exports for the seven years, 1876 to 1882 both inclusive, were 524,680,520 bushels of corn, which was 168,000,000 bushels more than the combined exports during the preceding 55 years. The total of the six principal grains raised in 1880 was 2,718,193,501 bushels on 120,926,286 acres. In 1881, though the acreage rose to 123,387,770, the yield was 650,000,000 bushels less.

The information given as to the sources of gutta-percha, and the importance of protecting and of diffusing plants producing it in appropriate localities, fills a noteworthy part of the report on the progress and condition of the Royal Gardens at Kew. The time cannot be far distant, the report tells us, when the natural sources of gutta-percha will be definitely used up. Unlike caoutchouc, which is derived from milky-juiced plants of many natural families, gutta-percha appears to be only yielded by species of *Sapotaca*, the principal source in Malaya being the plant now known as *Dichopsis gutta*. Much requires to be ascertained with reference to the trees yielding Bornean gutta-percha, and much, in view of the fact that the "running out of existent natural sources of gutta-percha is an event within measurable distance," remains to be done in protecting the forests and in developing the culture of the trees in appropriate localities elsewhere. First of all, however, it is necessary to know for certain what are the trees which yield the precious juice, and to do this suitable specimens in a fit state for botanical analysis and determination should be procured. It is obvious, or ought to be, to practical men intent on developing such sources of industry, that the accurate determination of the plant is the first thing to be done, and nowhere can this be better done (if proper material be forthcoming) than at Kew.

Mr. Lewis P. Muirhead, Kilcreggan, writes as follows on the subject of the origin and practice of Ensilage :—

"Sauerkraut? Sauerkraut! Yes, that's it; what is good for man is surely good for beast. I'll try it anyhow." So thought an old German farmer one wet season upwards of eighty years ago, only in carrying out his idea for cabbage he substituted cut grass, clover, and vetches, omitted the pepper-corns, and used a pit in the ground instead of the family barrel or crock (*irdone hagen*).

"Some years after such words as 'Salzfutter' (sated fodder). 'Sauerfutter' (pickled fodder), and 'Viehsolat' (cattle-salad), might be heard among the farmers of Germany and East Prussia, where the practice first obtained a hold, thereafter being carried by emigrants as far as America, and gradually finding its way among the Dutch and French nearer home.

Mr. Thomas Christy, F.L.S., of Fenchurch-street, London, whose work in connection with new commercial plants is well known, has issued a note regarding the kola-nut tree, in which he says :—"I introduced the kola-nut (*Sterculia acuminata*) into England about eight years since, and it has lately been subjected to European analysis, and the result obtained make it exceedingly likely that a large European demand will soon exist. It has been found to contain the same active principle, *viz.*, caffeine, and more of it than the best coffee, and to contain also the same active principle as cocoa, but less fatty matter. Possessing the same qualities as these favourite beverages, it only needs proper treatment to develop a special flavour, and it would then probably be able to compete successfully with those beverages. The nuts are used to form a refreshing and invigorating drink throughout a large portion of tropical Africa, their use being said to support the strength, allay inordinate appetite, assuage thirst, and promote digestion, and to render those using them capable of prolonged fatigue. The Negros prefer them to tea or coffee, and when they can obtain kola-nuts will not touch coffee. Dr. Daniell says of them :—"It would be difficult to find any product which constitutes such an important article of commerce in Soudan as the kola-nut." Wherever the Negro has been transplanted to a foreign country he has taken the kola-nut with him.

As a medium of exchange for the products of Central Africa, no article could be more advantageous, and on this account alone the tree will well repay cultivation. Moreover, if once introduced as a beverage in civilised countries, the demand for it would soon become enormous.

I have recently been informed by Mr. Espeut, a well-known sugar-planter of Jamaica, that the Negros use the kola-nut as a remedy for drunkenness; that swallowing a single nut,

ground up and made into a cream or paste with water or spirits, no sign for intoxication remains half-an-hour afterwards. Confirmatory evidence of this property in the kola-nut is given by a surgeon, Mr. Papello, who tells me that alcoholic drinks do not produce intoxicating effects when the kola-nut is eaten at the same time. It appears, therefore, that the craving for drink, which is such a strong incentive to drunkenness, may be subdued by the use of this valuable stimulant and tonic, as after chewing kola-nut great disinclination is felt to all forms of alcohol. It has also been found to possess a beneficial action on the liver, its continual use preventing attacks of despondency, to which negroes are peculiarly liable. Dr. Daniell records a case of this kind in which the kola-nut put a stop to an epidemic of suicidal mania, which threatened at one time to depopulate the estate on which it occurred.

It is also used by the natives when in a low state of health, and suffering from the skin cracking and peeling on the hands and feet.

Merchants on the West Coast of Africa always have a stock of these nuts, which can be kept perfectly fresh in moss, and when they have a hard day's work to do, they nibble at a nut during the day; this enables them to go through their work without fatigue, and prevents sleepiness.

I have just received from a native gentleman on the West Coast of Africa a fair quantity of fruit in splendid order, as fresh as if just gathered from the tree.

Planters will be able to send them off for seed at once to their estates.

Some have been sent to the leading medical men in London for further experiment, and I am endeavouring to ascertain the best plan of preserving their medicinal properties.

In the December number of the *Agriculturist* for 1882, we published a letter of a correspondent regarding the crushing of mustard seed and the extracting of the oil. We have made enquiries regarding the presses in use, and Dr. Hugh W. McCann, the officiating Secretary of the Bengal Economic Museum, has been kind enough to favour us with a note, in which he says:—

There is no information to be had in the Museum files. An elaborate description of oil presses, as employed in Europe, will be found in Ure's Dictionary under the article *Oils*, but I fancy none of these European presses have been introduced into India. I may refer you to Powell's Punjab Products I, p. 431, and to Dr. M. C. Cooke's report on the oil, seeds and oils in the India Museum, pages 3 and 4, for remarks on the possibility of introducing the simpler kinds of European oil presses, or some modification of them, into India. I heard on enquiry that Messrs. Khetter Mohun Bysack and Sons, of 3, Prosonno Coomar Tagore's-street, had patented an improvement on the native oil press worked by steam, and I applied to them for particulars. They have sent the reply, of which I enclose a copy. Your correspondent states that the outturn of oil by a native press is about 3 maunds a day. Messrs. Bysack and Sons state that the ordinary native oil mills crushes mds. 1-5 of oil-seeds in 16 hours, whilst their patent press crushes Bazaar mds. 2-10 in 24 hours, or nearly twice as much. The oil extracted would, of course, be considerably less in weight than the oil-seed pressed: so that the figures supplied by Messrs. Bysack and Sons are very considerably less than those of your correspondent.

The following is Messrs. Khetter Mohun Bysack and Sons' description of their patent oil mill:—

A pair of our oil mills takes up a space of 6' × 10'. The mortar is made of wood, and the frame on which it works is made of cast-iron, having a step and a bevel wheel fitted on to it. On the bevel wheel the wooden mortar is attached, and on the side of the frame there is a block, in which the pinion pulley shaft works, and which works the wooden mortar. There are also attached to the frame two tie rods which hold the upright wooden square stand of 4" on which the friction roller box with rollers is attached.

The two friction rollers press against the side of the mortar, and on the other side of the square stand of wood is a lever of iron, to which is attached a chain with a cap which holds the head of the pestle and presses the oil from the seeds by means of weights hung at the end of the lever.

The mortar is a block of wood hollowed out in a special form and bound with wrought-iron bands.

The pestle is of hard wood. In this there is a considerable advance on the ordinary primitive native oil mills worked by bullocks, which crush in 16 hours mds. 1-5 oil-seed, and which require three bullocks and a man for the working.

Our patent oil mills are driven by an engine at ten revolutions per minute, and the power required is a quarter horse-power.

The mills can crush mustard, poppy, til, linseed and cocoanut kernel, and will crush in each mill in 24 hours mds. 2-10.

The durability of our mills is three times greater than the primitive native mills. The construction is simple and requires no foundation.

The mortar requires to be renewed in 6 or 8 months according to the quality of the wood: the pestle about every month.

Ordinary and not skilled labour is required, and one man can look after the working of six mills.

The establishment of an agricultural class in the vernacular, for zamindars' sons at the model farm, Hyderabad, Sind, is, we think, an effort of considerable moment, which is likely, we hope, in the future to make its influence felt on Indian agriculturists. There is no royal road to learning, neither is there a royal road to the improvement of indigenous methods in agriculture. This end may be approached from many sides and worked at in innumerable ways, all tending towards the same result. Of all the means used hitherto in India to make some sensible impression on native agriculturists, the establishment of a class for zemindars, such as the one noticed above, is in our estimation the most promising.

Colonel Sladen, the Commissioner of Arrakan, found the pepper vine growing wild in the Sandoway district, and a farm under Government auspices was started at Sandoway last year, to see if it was possible to introduce a new article of export for the Arrakan division. The cuttings of the pepper vine grow readily, but it takes three years for them to bear fruit, when they usually last for seven or eight years. The Sandoway farm consists of 623 acres, and by 1885 it will be possible to judge of the commercial success of the undertaking, which, as but little labour is required after the first year, should suit the Burmese admirably. Probably the pepper vine would thrive equally well in other parts of the province, and it would be easy for an acre or two of cuttings to be planted in places where Government already possess experimental gardens, such as at Magargee on the railway line to Prome, at Pahpoon, where the Deputy Commissioner has already successfully grown sugarcane, coffee, and, we believe, tobacco, and at Tounghoo, where Mr. Petley, a private gentleman, has a plantation of coffee, tea, cinchona and potatoes, situate on the elevation of about 2,500 feet above the sea. It is on such hills—and there are many like them in Burmah—that the Eurasian Association of Madras might profitably assist some of the race to make a new start in life. The climate is good, and for the tropics fairly cool for nine months out of the twelve, while almost every description of crop could be profitably raised, or farm produce which would be easily brought to a good market. Will the project of sending butchers' meat from Mysore to Madras, where it is cheap and abundant, ever succeed? In this province, where good meat, milk, butter, eggs are much more expensive, there are good openings for industrious East Indians in this line.

We desire to call the attention of our readers to the letter on Divi-Divi which appears in our columns, and to the extract on the same subject which we reproduce under "selections". Notes and letters on the same topic appeared in our columns on the following dates—July 1881, page 191; December 1881, page 349; July 1882, page 242; and March 1882, page 69. Actual experiment seems to have placed beyond dispute the very substantial returns which may be obtained from carefully planted tracts of land sown with Divi-Divi. What, however, seems to be wanting is a variety of experiments under different conditions of soil, general treatment, &c., in order to establish conclusively the best methods to be adopted in perfecting and extending this very promising product.

Reporting on the trade and commerce of Rio Grande del Norte, &c., Consul Bolsham says that India rubber does not appear to progress as it promised, the ultimate extraction showing that the *mangabura (Hancornia speciosa)* has become exhausted, the reason probably being that the land where they grow is very dry, and different from the land in the provinces of Para and Amazon.

An interesting paper on the food value of cotton-seed was recently read by Professor Gulley before the Society for the Promotion of Agricultural Science at Montreal. Estimating the

cotton seed at 10 cents per bushel, and oat straw and coarse hay at 10 dollars per ton, the average cost of food consumed per head per day of cows experimented upon during the past winter was 7 3-10th cents, cows averaging one and-a-half gallons of milk per day. One steer, fed for beef, weighing 700lb, when shut up gained 260lb live weight, or an average of over 4½lb per day, consuming an average of 14 4-10lb of seed per day, and 11lb of straw and hay. Average cost of food per day not quite ten cents. Other experiments, pursued at the State Agricultural College of Mississippi, showed that boiled cotton-seed, with any kind of straw or hay, would cause cattle to fatten rapidly, no matter how poor in condition. It also makes very rich milk, the oil of the seed seemingly appearing in the milk in the form of cream. The quality of the butter, however, when the cows are fed largely on cotton-seed, is poor.

The International Agricultural Cattle Show, which will take place in Hamburg in July 1883, promises to be a very extensive one. The board of management, in framing the programme of the exhibition, has taken into consideration the different suggestions which have been supplied from agricultural societies in Germany and other countries, as well as from private breeders, and having in this way given general satisfaction, has received support from all parts of Germany. Some doubts which have been expressed by German half-blood horse-breeders, have been removed through an alteration in the programme. Very favourably has that part of the programme been received by the breeders of horses and cattle, which enables the jury to award prizes, which were originally intended for one kind of cattle, to another of which there may be a greater number. At a meeting of the East Prussian horse-breeders, which took place in Insterburg on the 28th October, it was resolved to send East Prussian horses to the exhibition. The breeders from all parts of Germany, north as well as south, have signified their intention to send their cattle to the exhibition. But not only in Germany, but also in other countries the exhibition is receiving particular attention. Committees have been formed in England, Austria-Hungary, Belgium, Holland and Sweden, &c., to promote the interests of the exhibition. The breeders of Switzerland are going to send their produce collectedly, and the government of the country has expressed it willingness to pay their expenses.

The Council of the Royal Agricultural Society of England have at their meeting of the 1st November chosen six of their members to represent England at the Hamburg exhibition, and to promote the interests of the English breeders. As regards France, the Ministre d'Agriculture has taken in hand himself to induce the French farmers to take part, and the Consul General in Hamburg, Count de Piun de Saint Didier, takes great interest in the exhibition. Russian farmers have already signified their intention to send horses to the show, and American papers are warmly recommending it to the farmers of that country. From all these considerations, it seems certain that the work which has been taken in hand by a number of citizens of the old Hanse town is likely to be a success. Whether breeders of Indian cattle may be induced to exhibit is a matter for speculation ; so far as we are aware, there is not much likelihood unless the Government should take the matter up.

The *Ceylon Observer* has the following :—"The notice of Father Palla's benevolent attempts to establish the silk industry in Ceylon, led us to peruse with fresh interest some notices of Sericulture in Bengal and Mysore, which we found in the *Indian Agriculturist*. For the greater portion of half-a-century now, we have followed the history of experiments to revive what was once an important industry in India. Failure in every case, or at any rate, the slight improvement which has resulted from large expenditure of time, attention, and money, seem due to one cause—the inability of the Indian peasantry, from want of intelligence, or want of care, or both, to spin the silk into decently even thread. It is clear, therefore, that if Europeans do not take up the enterprise of introducing and keeping up a stock of superior worms, and unless the Indian peasantry can be induced to spin the cocoons into thread more carefully, the enterprise must come to be an end. It seems to be at present kept alive only by the demand for floss silk. The great question as regards Ceylon is—Are our labouring classes, who are likely to be employed in breeding the worms and spinning the filatures of such a superior stamp, physically and intellectually, to the wretched Bengalees, that real and steady good work can be expected from them ? We should like to hear the experience of Father Palla and others in this respect.

The latest use to which the kola-nut has been applied is the manufacture of kola-nut beer. The maker claims for this beer that whilst it is warranted to be non-intoxicant, it contains far more sustaining and stimulating power than an equal quantity of Bass or Allsopp's brew. It is certainly a very palatable drink, and if the temperance party should take it up, there need be no doubt of its success. *S. acuminata* grows about forty feet high, and bears pale yellow flowers spotted with purple ; its leaves are about six or eight inches long and pointed at both ends. Under the name of *kola*, or *kolla*, or goora-nuts, the seeds of this tree are extensively used as a sort of condiment by the natives of Western and Central Tropical Africa, and likewise by the Negroes in the West Indies and Brazil, by whom the tree has been introduced into those countries. In Western Africa the trees grow mostly in the vicinity of the coast, and an extensive trade is carried on in kola-nuts with the natives of the interior ; the practice of eating kola extending as far as Fezzan and Tripoli. A small piece of one of these seeds is chewed before each meal as a promoter of digestion ; it is also supposed to improve the flavour of anything eaten after it, and even to render half-putrid water drinkable. There are several varieties of kola-nuts ; the common kind has an astringent taste. Powdered kola is applied to cuts.

The *Samarang Vanderland* reports that "the company of Dutch capitalists, who have undertaken to open up for trade and industry the 32 islands in the Malaccas known as the Bakian group, has a promising future before it. This company began operations on the 1st. January 1881. Since then, a fishing village there, fixed upon as head-quarters, has been transformed into a town, with hospital, warehouses, &c., and 5,000 piculs of dammar have been collected for export this year to Europe, valued at 150,000 guilders. This gum will for the present be the principal export article therefrom, the quantity available being so great that the company counts upon being able to export from the beginning of this year 2,000 piculs of dammar per month at the price of 30 guilders each, thus representing a value of 720,000 guilders a year. Even at this rate, it is said that years will elapse before the old stock can be cleared away ; nature meanwhile accumulating fresh supplies. The second product of importance is sago, which can be had for the mere taking, the trees yielding this article forming extensive forests. Next year the company intend to lay out coffee, cocoa, and clove plantations, with coolies from Java, the islanders, from their fewness and laziness, being unavailable for labour."

Sir J. B. Lawes, Bart., writes as follows on ensilage :—

I have recently received from the United States a pamphlet containing an account of experiments with ensilage, carried out at the Agricultural College at Lansing, Michigan. Although these experiments have been conducted with much care and at considerable expense, it has not been thought necessary either to weigh or analyse the maize as it was placed in the silo. We are, therefore, compelled to draw our conclusions as regards these points from the general analyses of maize in flower, and compare them with the composition of ensilage as given in the pamphlet.

The ensilage used in the feeding experiments, as analysed by Professor Neal, gives the following constituents :—

Water	82·27
Ash	1·94
Carbo-hydrates	8·08

The analysis of the green maize, as given by Dr. E. Wolff, are as follows :—

Water	...	82·0
Ash	...	1·1
Carbo-hydrates		10·9

We see, therefore, that while the ash has greatly increased, the carbo-hydrates have very much diminished.

In the *Journal of the Chemical Society* for the present year, there is an article by C. Lechartier on the modification which green fodder undergoes when preserved in pits. The analyses were made upon maize and clover. In the unfermented maize, 100 parts dry contain 25 parts of starch and sugar ; after fermentation, 15 parts. In 100 parts of clover before fermentation he found 19 parts of sugar and starch ; after fermentation, 7½. Alcohol and carbonic acid are found in considerable amounts in the fermented material ; there appears also to be a small increase in the fatty matter of the fermented material, but whether this is a food product is not known.

In the experiments upon the feeding properties of ensilage carried out at the New Jersey experimental station, four cows were selected from a herd for experiment. For a period of twenty-eight days all received exactly the same amounts of food, consisting of clover hay, wheat straw, brewers' grains, cotton seed meal, and turnips. During this time No. 1 gave an average of 23½lbs. of milk daily ; No. 2 gave 25·1lbs. ; No. 3, 25·6lbs. ; No. 4, 24·1lbs.

In a second period of twenty-eight days the cows Nos. 1 and 2 were fed with exactly the same food as before ; while Nos. 3 and 4 received the same, with the exception that 100lbs. of ensilage was substituted for 40lb. of turnips.

Under the same diet as before, the cows Nos. 1 and 2 increased their daily product of milk 1½lb. and 1lb. respectively ; but those which received the ensilage showed a trifling decline.

It will be observed that the only change in the diet of the cows Nos. 3 and 4 in the second period, was the substitution of 100lbs. of ensilage for 40lbs. of turnips. The description of turnips used is not stated, but the dry matter in the 40lbs. would not amount to more than from 3 to 5lbs. ; while 100lbs. of ensilage would contain 18lbs. of dry matter ; and this large increase in food we find was followed by a slight decline in milk, and yet ensilage is said to be above all things suitable to the production of milk.

It is stated further that the total cost of growing an acre of Indian-corn, including cutting it up and putting it into the silo, amounted to 41·81 dols., or about £8 14*s.* ; and that the weight of the product from the silo was 40,000lbs. Assuming that 100lbs. of ensilage was equal in its milk-producing power to 40lbs. of turnips, about 7 tons of turnips would be equivalent to 40,000lbs. of maize. But surely 7 tons of turnips can be grown for a less cost than £9 !

I am quite prepared to believe that ensilage is a success in the United States, but, for some reason, which it is not in my power to explain, the evidence brought forward at present, as derived from experiments, is not so much in its favour as we might expect, and we have certainly no crop in this country which could be compared with Indian corn as adapted for the process.

I submit, therefore, that the evidence at our command at the present time does not hold out much inducement for those engaged in agriculture in this country to enter upon the construction of silos.

From a recent report on the trade of Persia it seems that silk, once the staple produce of the country, is not likely to maintain its position much longer. Owing to the silkworm disease, which destroyed crop after crop the peasantry of Ghilan have turned their attention to the cultivation of rice, which, as a crop, seems to suit them better, as it requires less trouble to cultivate, and is, moreover, in itself an article of food upon which they principally subsist ; it is also extensively exported to Russia. Another article which has replaced silk is opium. In Kermanshah until ten years ago the cultivation of opium was very limited, not exceeding 675lbs. a year, required for local consumption. Last year's crop yielded about 13,500lbs., and it was expected that this year's would realise double that quantity, but it was affected by cold, and consequently did not realise more than 9,450lbs. From Ispahan it is reported that this year's crop has been partially injured by cold, but that it is richer in juice than that of the preceding year. No change or improvement, it is stated, has taken place in the preparation of the drug, beyond a large admixture of oil introduced to suit the taste of the Chinese, the proportion being about 6lbs. or 7lbs. to each chest of 141lbs. Very low prices were obtained in foreign markets for Persian opium last year, in consequence of which it is said by some that unless prices rise in China the poppy cultivation will not be further extended. The drug is prepared at Ispahan, Shiraz, and Yeza. After being dried in the sun it is manipulated. That destined for China is mixed with oil ; that sent to London is exported in its pure state. Persian opium is reported to have lost in the estimation of the Chinese ; from this it may be inferred that adulteration must have considerably increased. In Khorassan the cultivation of the poppy has increased tenfold within the last ten years. It grows everywhere in cold as well as in hot districts ; every landed proprietor cultivates it, and it may be said that one-eighth of the entire produce of Khorassan is poppy. In Yeza it seems that this year's crop suffered much from cold, resulting in the produce of about half last year's crop. The oil used for mixing with the drug destined for China is linseed oil.

At the instance of the Government of India, the Superintendents of Government Farms, Sydapett, and of the Central Jail, Coimbatore, were called upon by the local Government to consider and report upon certain papers regarding the cultivation of cotton of the natural khaki colour. Mr. Robertson, the superintendent of the Farms, in replying, has forwarded samples of Nankin cotton in the seed, and the clean lint, and states that the cotton has been grown in this Presidency as a botanical curiosity for upwards of fifty years. It was orignally imported from China, where the fabrics made from it are in great demand for their cheapness and durability. At one time large quantities of Nankin cloth were exported from China, but its export has now almost ceased. Mr. Robertson does not think the crop is grown anywhere in this Presidency except on a very small scale, but he is putting an acre of land under the crop, and this should in four or five months give enough seed for 20 or 25 acres of land, which will probably suffice for experimental trials. Mr. Grimes, Superintendent of the Coimbatore Central Jail, reports that from two seeds he was enabled to plant at different times twelve acres of land. It is a hardy description of cotton grows, in any jail, is perennial, and gives more than one picking a year. The plant in the field grows to a height of about eighteen inches, but in favourable localities it grows into a large bush, quite four feet in height. He has submitted for inspection some of the cotton in the pod, some hanks of thread spun by the convicts from it, and samples of cloth made therefrom in the jail. Brigadier-General Clerk was supplied with some of this "Nankin" cloth to try its suitability for the summer clothing of troops. Owing to recent orders of Government putting a stop to miscellaneous manufactures in jails, Mr. Grimes rooted up the last field of this cotton, which was planted in 1879, as he thought there would be no further use in cultivating it. He has, however, means of obtaining seed and can recommence its cultivation if necessary. He believes it is not cultivated by the ryots in the Coimbatore district, but is told that it is so in the Tinnevelly district. Its great drawback is its shortness of fibre, and Mr. Grimes is anxious to obtain fresh seed from Chunar or elsewhere to ascertain whether it is superior to what he has grown. It will be thus seen that the *cultivation* of this cotton has passed beyond the experimental stage in this Presidency, and the Government of India have now an opportunity of pronouncing on the merits of a sample of the cloth made from it at Coimbatore. A supply of Chunar seed is to be procured in order that its identity with this cotton may be established. Meanwhile the local Government, we hear, does not think there is any need for extended cultivation here, but that a supply of seed should be maintained for distribution to cultivators in the event of a demand being eventually established.—*Madras Times.*

ARBORICULTURE.

(Continued from page 18, Vol. VIII.)

SAL WOOD is used for cart wheels, and in most localities, in addition to the wheels and axles, the frame-work of carts and shigrams, and rough work, is made of sâlwood. Sâlwood is not quite free from attacks of white-ants, and sâl planks, the thickest of its kind, will split under the sun, and if thin, will warp; but it resists decay under water remarkably well, for which quality it is extensively used for bridges made wholly of wood. Sâlwood is not valuable for furniture, because it is not close grained, is not elastic, has no beauty in it, no laminations, and cannot receive high or any polish at all. It is a strong, durable, and rough wood. A century ago we had extensive forests of mature sâl in India, at the foot of the Himalayan mountains, ascending up to 4,000 feet both in the territories of the British Government and those of the Maharaja of Nepal; but they have now been mostly used up, and replaced by saplings of 20 or 25 years old; even these are constantly cut down, where the British Government reserved forests do not exist, to supply the wants in house-building. Twenty-five years ago mature sâl logs, 100 feet long with a maximum girth of 15 feet, were very common, lying in heaps on the banks of the Gogra and Raptee, now altogether scarce owing to heavy indents by the railways for their buildings, and sleepers. I do not know what these railways will do when the old timber is worked out; because the forests are exhausted of mature trees and the saplings will take 500 to 1,000 years in coming to maturity. Sâl saplings grow fast enough in three year's time under favourable conditions, and in the forest, acquiring a height of 30 to 40 feet, having very thick bark, no heart-wood, but mostly soft sap-wood. In the Coosmi forest in the Goruckpore district, and some of the Oudh forests in the Kheri district, I have found sâl growing along-side with *Terminalia tomentosa*, 150 feet in height without a bough up to 140 feet. This tree grows from seed sown in June or July, can bear transplanting, but it grows better if the tap-root be not disturbed or mutilated.

NATURAL ORDER, COMBRILACEAE.

Terminalia tomentosa (Roxb.); H. *Asana.*—A lofty, fast-growing tree, very common in the forests of Oudh and N.-W. Provinces, at the foot of the Himalayan mountains. It generally grows in the same forest with *Shorea robusta*, preferring the same soil, climate, and elevation. The pith of the bark of this tree is beautifully red, containing tannic acid, much used by the *Chamars* residing in or near the forest, in tanning leather. *Asana* timber resembles in colour the *shishum*, is somewhat blackish, but is much lighter and wanting in the streaks found in *shishum*. It is neither strong nor tenacious, but can be worked easily enough: fit for pannels of doors and windows. It cannot bear weight, and therefore is not sought after for beams and rafters. *Asana* logs are pretty long and thick. I have seen trees 100 feet high furnishing good mature logs, mostly heart-wood, 60 feet long with a maximum diameter of 4 feet. The sapplings and branches are inferior to *sunkhoo*, weak, and soon destroyed by insects. This tree grows from seed sown in June or July.

NATURAL ORDER, SAPOTACEAE.

Bassia latifolia (Roxb.); H. *mahwa.*—The mahuwa tree is plentifully found in many parts of India. In former years Oudh was well stocked with this tree. Mahuwa is generally 80 feet high with a girth of 12 feet near the ground. Spirit is manufactured from the fleshy corola, also forming food for cattle and man; the seed is oleaginous, from which excellent oil can be expressed for the manufacture of soap, and the timber, though not suitable for furniture-making and other nice works, is good for well curbs, door-posts, and pannels for doors; it may also be converted into beams for buildings: no rafters, however, can be made, because mahuwa wood of small girth is very weak and not able to bear much weight. This tree is raised from seed sown in June or July. Goats feed on mahuwa leaves.

NATURAL ORDER, CASAREÆ.

Casuarina equistifolia (Forster).—This tree is a native of India, East Africa, and various other parts of the world. The height is lofty and the girth pretty thick, but the wood is not valuable for any other than purposes of fuel, affording great heat and little ash, well adapted for glass manufacture. *C. equistifolia* is content with humid sandy soil, where it will grow fast enough and afford abundant supply of fuel in 12 or 15 years. I have raised this tree from seed sown in July, which have attained lofty heights in 20 years' time. They are growing in poor sandy soil at Lucknow.

NATURAL ORDER, AMENTACEÆ.

Alnues glutinosa (Gaertner).—The ordinary alder tree of Europe and parts of Asia. It is 70 feet high, with corresponding thick stem. The wood is strong, durable, and waterproof, excellent for under-ground works, Charcoal obtained from the wood of this tree is considered one of the best for gunpowder. Grown from seed sown in September or October.

Castanea sativa (Miller).—This tree, of prodigious size, is very eligible for introduction into India. It is a native of South Europe and the temperate parts of Asia, and therefore will grow well in the lower Himalayas, and tracts at the foot of these mountains, such as Assam, parts of Bengal Proper, Oudh, and the N.-W. Provinces. Its common English name is "sweet chestnut tree," so named on account of its sweet edible fruit. Baron Mueller states that a sweet chestnut tree growing on Mount Etna has acquired the great size of 204 feet in circumference of the lower stem, and in other localities diameter of 10 feet of the stem is very common. The timber of this tree is finely laminated, is elastic, strong and durable, and capable of receiving a high polish; hence desirable for furnitures and other nice works. Forests formed of this tree are capable of affording material help in maintaining live-stock with the edible fruit in years of scarcity. The wood also forms choice fuel where it cannot find any other use. Raised from seed sown in September or October.

NATURAL ORDER, SANTALACEÆ.

Santalum album et S. rubrum (Linne); H. *chandan*, B. *chondon.*—The white and red sandalwood trees, so named from the colour of the wood. Small trees 30 to 40 feet high, very slow in growth, and ornamental in appearance. The white sandalwood tree is more common than the red. I have found small trees of both the species growing in large forests in Oudh and the N.-W. Provinces, 20 feet high, with a girth only 4 feet. Young trees do not yield the highly prized aromatic wood, only mature trees having it. Sandalwood is considered sacred by the Hindoos of India, and much sought for; but the wood is scarce and very costly. Forests of sandal trees might be formed in any part of Oudh, N.-W. Provinces, Punjab, Bengal, and Burma. These trees prefer high ground, having lime in the subsoil. Besides the uses the wood is put to by the natives of India, in making marks on their bodies and foreheads in honour of the gods they worship, and aromatic composition of native smoking tobacco, it can be used for furnitures, choice carved boxes, plates, and many other things, the wood always retaining its aroma. These trees are grown from seed sown in June or July.

NATURAL ORDER, RUBIACEÆ.

Cinchona officinalis (Linne).—This medicinal alkaloid-yielding tree is the type of the highly-prized and much appreciated *C. ledgeriana*, native of the mountains of New Granada and Peru found growing at altitudes varying from 6,000 to 10,000 feet. The bark is known by the name of 'crown bark' or 'brown Peru bark.' It is comparatively rich in the alkaloids *cinchonidin* and *quinin*. Much moisture is pernicious to this species, and flourishing to the best advantage at high elevation. *C. officinalis* is more delicate than *C. succirubra*. Propagation from seed, cutting, and grafts. Can also be hybridized.

Cinchona succirubra (Pavon).—This species is extensively grown in the mountains of India. It is a native of Peru and Ecuador mountains, requiring the same elevations as *C. officinalis*; but both of them have been grown successfully at lower elevations in India, Java, and Ceylon. *C. succirubra* being found more hardy and quick-growing, is used as stock for grafting *C. ledgeriana* on. This cinchona is poor in the alkaloids compared with *C. officinalis*.

NATURAL ORDER, LAUREÆ.

Cinnamomum camphora (Nees).—The well-known camphor tree of China and Japan. Small tree, 40 or more feet high, mentioned here as eligible for select plantation in suitable localities. This tree will succeed best on the mountains of lower elevation of Burmah, Bengal, N.-W. Provinces, and the Punjab, and in select localities in Oudh near the Himalayas, free from hot winds of the plains. The product, camphor, is extracted by boiling chips of wood and purifying the reduced matter. Mature trees furnish the largest quantity and best quality of camphor. The wood is valuable for many uses, emitting the fragrant smell of camphor. It is also free from all attacks of insects.

Cinnamomum cassia (Blume).—This cinnamon tree of South China, like the foregoing, will succeed in the same localities. The bark of the twigs supplies the cinnamon of commerce, which is inferior to *C. zilanicum.*

Cinnamomum zeilanicum (Breyan).—The true cinnamon tree native of Ceylon, growing up to 8,000 feet above the sea in that island, at which height the bark contains less aroma, at lower elevations the aroma being much stronger The leaves of this, and those of the foregoing tree, yield aromatic oil, and their roots camphor.

The cinchonas and cinnamomums are very choice and highly prized trees, requiring the utmost care and the best localities as to soil and climate for their propagation, hence requiring the special attention of people engaged in the enterprise of supplying India and other countries with their highly valuable products.

The cinnamomums are raised from seed sown in June or July. Seed might be procured from China, Japan, and Ceylon.

NATURAL ORDER, URTICACEÆ.

Morus rubra (Linne).—North American red mulberry tree, 70 or more feet high. It is mentioned here for the sake of its timber, wonderfully strong, compact, and lasting. Grown from seed or cuttings in February, or June and July.

NATURAL ORDER, MYRTACEÆ.

Eucalyptus amagdalina (Qabillardiere).—A very lofty tree, whose colossal structure rears itself up to 500 feet high, with corresponding thick girth. The timber of this tree is strong, elastic, durable, and can easily be worked into any kind of work. House-building, ship-building, railway sleepers, railings, fences, staves, and many other things too numerous to detail, are and can be made of the timber of this tree. It is an Australian tree, being one of the large number of species of the genus Eucalyptus, which for the most part fill the Australian forests, and have been found useful in their timber, gum, and tannic acid contained in bark and leaves. These majestic giants of the forest grow very fast and acquire girth and maturity for thousands of years. Some species of the Eucalypti have been tried in many parts of India—in Calcutta, Lucknow, Saharunpore, Lahore, and Southern India; and from all personal observations and published accounts, I find them well suited to India, and doing well. They were originally raised from seed, but cuttings obtained from them have also been found to succeed. In exposed localities in the hot plains of India, Eucalyptus tree, grown singly at long intervals, do not fare well owing to its quick growth and weak slender stem, liable to be broken down by storms and hurricanes. A fine eucalyptus tree in the Lucknow Agri Horticultural Gardens met this fate. When a regular forest is formed of these noble trees, there is no fear of storms and hurricanes injuring them on account of the support of the neighbouring trees. The Eucalypti will grow remarkably well within a belt of 200 miles from the foot of the Himalayas, stretching from the Eastern frontier of Bengal to 1,500 miles westward to the Afghan frontier. These trees will grow on *poor sandy soil*, as I have found them growing on such a soil at Lucknow. Seeds of the Eucalypti can easily be procured from Australia, from Baron Mueller.

II. CLASS MONOCOTYLEDONEÆ.

NATURAL ORDER, GRAMINEÆ.

To every one in India the name of bamboo is familiar; but every one knows such bamboos only which are found in places where he is located. For instance, in Oudh, there is one variety of bamboo called *kat bansi*, on account of the long spines, known to botanists by the name of *Bambusa spinosa* of Roxburgh. This bamboo takes up great deal of space, does not grow straight, but from a certain height obliquely and crookedly, crossing other stems, throwing out dense spiny branches, forming impenetrable and formidable bush, which would retard and repel cannon balls (for which quality it used to be planted outside the *gurhs*—forts—to baffle and repel the attacks of enemies), by which extraction of the stems becomes very difficult and expensive, and therefore not profitable. Judging from this bamboo, the people of Oudh would shrug their shoulders on hearing of *bamboo cultivation*, being no doubt ignorant of the large number of species free from thorns, perfectly straight in growth, easy of extraction, strong and durable, and useful in multifarious ways. Bamboo in its humble way is as useful, nay, in some instances more, but far cheaper than timber. In China, Japan, and Burmah, houses are built of bamboos, fancy trays and baskets, richly lacquered work-boat masts, fishing, rods, sticks, *morhas* and couches, sericultural apparatus of all kinds, and many other things are made in these places and in India (where available, but in less ingenious fashion). A chief recommendation for the cultivation of bamboo is, that it grows very fast, coming to maturity in 3 to 5 years. In most parts of India the bungalows are made of sun-dried bricks, whitewashed, door and door-posts and windows made of wood, and the rest having bamboo work. When bamboo is not to be found, saplings of *Shorea robusta*, or that of *Acacia arabica* (if available) are used. The bamboo region stretches from the Lower Himalayas to Lower Bengal, the whole of Burmah (British and native), all Siam, China, and Japan, in the continent of Asia. These places have the best bamboo whether for industrial or for decorating purposes: in addition to these, some genera and species highly valuable are also found in South America, parts of Africa situated near the sea, Ceylon and Java, the Phillippine Islands and Madagascar. The bamboo genera are very numerous, and have many species and varieties. I will mention some of them which will grow in the plains of India, where this very useful plant is not to be found, forming artificial bamboo forest.

Bambusa aspera (Poiret).—Native of the Indian Archipelagoes. A lofty bamboo, 120 feet high. The stem is thick and very strong: it is straight in habit of growth, and has no spine. Propagated from off-shoots—or from cuttings.

Bambusa vulgares (Wendland).—The common spineless bamboo of Bengal. It grows very fast, acquiring the height of 40 feet in one growing season (rainy weather). The maximum height hitherto, under no care whatever, observed, is 70 feet. The stem of this bamboo is extensively used in Bengal for building purposes and is the one known to the people of Western Bengal, N.-W. Provinces, and Oudh by the name of *Chaboo bans.*

Bambusa balcooa (Roxb.)—Another bamboo of Bengal, 70 feet high, spineless, strong, durable, easily split and worked into fine slices for manufacturing baskets, mats, &c.

Bambusa Brandisii (Munro).—Native of the Tenasserim division in British Burmah. The stem is 120 feet high, two feet in circumference, hollow, but pretty thick in the pith, strong and durable. It is spineless.

Chusquea lorentziana (Grisebach).—Sub-tropic Argentina in South America is the native habitat of this bamboo. It is not lofty, only 30 feet high, but is solid, very strong and durable, and affords much material for manufacture of many bamboo things; is also excellent for buildings.

THE MAIJI EXHIBITION AND HORSE SHOW, 1883.

THE Maiji Exhibition and Horse Show for 1883 will open on Monday, the 5th February, and prizes will be issued about eight or ten days after, the intervening days being occupied by the judges in examining and awarding prizes. The date of distribution of prizes can be ascertained on application to the mamledar. All exhibits should be consigned to the mamledar, and should be accompanied by the certificates required by the terms

and conditions connected with each class. Exhibits will not be received after Monday, the 5th, except in the case of perishable articles, which will be received up to the time of examining the particular class concerned. The total value of the prizes amounts to Rs. 5,695.

A.—Horses and Mules—60 Prizes, aggregating Rs. 2,970.

	Colts.	Rs.
1.	Yearlings, *i.e.*, up to 2 years, five prizes, Rs. 35, 30, 25, 20, and 15 ...	125
2.	Colts 2 to 3 years, five prizes, Rs. 40, 35, 30, 25, and 20 ...	150
3	Ditto 3 to 4 years, five prizes, Rs. 45, 40, 35, 30, and 25 ...	175
4.	Ditto 4 to 5 years, five prizes, Rs. 50, 45, 40, 35, and 30 ...	200
	Total ...	650

	Fillies.	Rs.
5.	Yearlings, *i.e.*, up to 2 years, five prizes, Rs. 35, 30, 25, 20, and 15 ...	125
6.	Fillies 2 to 3 years, five prizes, Rs. 40, 35, 30, 25, and 20 ...	150
7.	Ditto 3 to 4 years, five prizes, Rs. 45, 40, 35, 30, and 25 ...	175
8.	Ditto 4 to 5 years, five prizes, Rs. 50, 45, 40, 35, and 30 ...	200
	Total. ...	650

	Mares.	Rs.
9.	Country-bred under 13-2, six prizes, Rs. 80, 70, 60, 50, 40, and 30 ...	330
10.	Ditto 13-2 and over, six prizes, Rs. 90, 80, 70, 60, 50, and 40 ...	390
11.	Stud-bred, six prizes, Rs. 100, 90, 80, 70, 60, and 50	450
	Total ...	1,170
12.	Miscellaneous class for animals deserving of notice, but which are ineligible for various reasons for competing under other classes, Rs. 250, to be divided in small prizes at discretion	250
13.	Mules, Rs. 250, to be divided in small rewards at discretion to those that have had their mares covered by the Government donkey stallions, and a double reward if the mares are in foal or have foals at foot	250
	Grand total ...	2,970

Terms and Conditions.

Batta at the rate of 4 annas a day for a mare and 2 annas a day for a grass-eating colt, filly, or mule, will be allowed for unsuccessful animals, from the morning of the day of entry on the exhibition rolls to the evening of the day prizes are awarded, and in the case of animals gelt, to date of discharge by gelder. Where an animal is registered after 12 o'clock in the day, only half that day's batta will be allowed. On the special recommendation of the committee, batta will be given for the journey from and to their home to unsuccessful exhibits. A trained gelder will be provided by Government, and all expenses will be defrayed out of the Exhibition Fund.

No prizes are allowed for country-bred colts or fillies, or for mares covered by country-bred horses (no matter how good), as the object is to encourage breeding from Government stallions only. The usual certificates from officers in charge of stallions will have to be produced to prove the breed of young stock, or the covering of their dams.

Animals lean or out of condition will not be allowed to compete. Mares that have received prizes at previous Government shows are not eligible for prizes again, the object being to encourage new animals. Mares must be either covered, in foal, to, or with foal at foot, by Government stallions, or the owners must have them covered at Malji; without this, they cannot compete. The order insisting upon gelding as an indispensable qualification for a prize is cancelled this year, but where an entire colt and a gelding are equal in merit, the Committee will give the preference to the latter, and a gelding prize winner will receive in addition a bonus equal to the amount of his prize.

Fillies must be stud-bred or they cannot compete.

A consolation class is opened under No. 12.

The prohibition against prize winners of previous years competing again does not apply to young stock, which can of course compete under different ages yearly.

B.—Cattle, Sheep, and Goats—(137 prizes, aggregating Rs. 1,525).

1.	Bulls, 15 prizes, five of Rs. 5, five of Rs. 10, five of Rs. 15 each, total ...	150
2.	Cows do. do. ...	150
3.	Bull calves do. do. ...	150
4.	Cow calves do. do. ...	150
5.	Field bullocks in pairs, 15 prizes, Rs. 5 of 10, five of 15, and five of 20 each ...	225
6.	He-buffaloes, 15 prizes as for bulls ...	150
7.	She-buffaloes do. do. ...	150
8.	Buffaloe calves (bull) do. ...	150
9.	Do. (cow) do. ...	150
10.	Sheep, Rs. 50 to be divided in small prizes at discretion, ranging from Re. 1 to Rs. 5 each	50
11.	Goats do. do. ...	50
	Total ...	1,525

Terms and Conditions.

Batta will be allowed for unsuccessful animals from the morning of the day of entry on the exhibition rolls till the evening of the day prizes are awarded, at the rate of 4 annas a day for each bull, cow, bullock, and buffaloe, and half this rate for grass-eating calves. No batta will be allowed for unweaned calves, or for sheep and goats. In the case of animals registered after 12 o'clock in the day, only half that day's batta will be allowed. Animals lean or out of condition are ineligible for competing, also those that have received prizes in previous years *i.e.*, grown up live-stock, the object being to encourage new animals; but where young stock are divided into ages, at the discretion of the judges. A prize winner of a previous year, may compete in a class of a higher age this year.

C.—Agricultural Produce.—(86 prizes, aggregating Rs. 950).

		Rs.
1.	Cotton of any variety (except Waradi or old Khandeshi) cleaned or uncleaned 18 prizes, one of Rs. 50, one of Rs. 30, one of Rs. 20, five of Rs. 5, five of Rs. 10, and five of Rs. 15 each, total ...	250
2.	Food-grains, 15 prizes, five of Rs. 5, five of Rs. 10, and five of Rs. 15 ...	150
3.	Oil-seeds do. do. ...	150
4.	Fibres, 10 prizes, five of Rs. 5, and five of Rs. 10 each	75
5.	Tobacco do. do. ...	75
6.	Dyes do. do. ...	75
7.	Sugarcane and jagri do. ...	75
8.	Vegetables, fruits, flowers, plants, and medicinal drugs, &c., Rs. 100, to be divided in small prizes at discretion, ranging from Re. 1 to Rs. 5 each ...	100
	Total ...	950

Terms and Conditions.

The quantities exhibited should not be less than the following in the cases given below :—

Cotton	...	...	... 25 seers.
Food-grains and oil-seeds	...	...	... 15 do.
Fibres, tobacco, and dyes	...	...	... 10 do.
Sugar-canes	...	...	... 50 in number.
Jagri	...	...	... 1 bheli,

and should be certified by the mamledar or mahalkari of the district, to be the produce of fields or gardens belonging to the exhibitor.

D.—Miscellaneous—(Prizes, value Rupees 250).

Prize for encouraging indigenous art and manufacture (textile fabrics, carts, brass and iron-work, pottery, leather-work, agricultural implements, &c.,). Rs. 250 will be divided in small prizes ranging from Re. 1 to Rs. 10 at discretion, care being taken that the market value of the exhibit is not ordinarily exceeded.

Rupees 250

Terms and Conditions.

These prizes are intended for *bonâ fide* manufacturers, who must produce certificates from the mamledars or mahalkaris of their district, that they, or the members of their families, manufactured the articles concerned, and that they are for sale at reasonable prices.

No prizes will be given unless the exhibits show some real improvement on the general make of similar articles usually made and sold in the bazaars, and are deserving of notice, owing to special merit, and are of real utility to the public, the object being to encourage progress, improvement, and economy.

OFFICIAL PAPER.

BEE-KEEPING IN INDIA.

GOVERNMENT OF MADRAS, REVENUE DEPARTMENT.

IN continuation of Board's Proceedings, No. 1632, dated 27th June 1882, and the correspondence relating to the question of bee-keeping and the gathering of wild honey in the Madras Presidency, the Board submit the following summary :—

2. Replies have been received from all Collectors.

3. The Collectors of South Arcot, Chingleput, Coimbatore, Kistna, Madras, and Salem state that they can add nothing to the information already published. In the Anantapore district, in six out of the seven talooks, about 300 maunds of honey are produced, the price varying from an anna to an anna and eight pies per seer of 21 tolas. In Madras honey sells at 4 annas a pound.

4. The following extracts from reports are appended.

5. The Collector of Cuddapah, Mr. L. R. Burrows, writes—

I have received reports from Sidhout, Cuddapah, Proddutor, and Rayachoti tehsildars. From these it is gathered that bee-keeping is not practised in this district. The following particulars are gathered from the several reports above mentioned :—

I. *Sidhout.*—Honey is collected in the hills by people of the Mutarachu caste and the Yanadies. The annual produce of the talook may be about 113 maunds, equivalent to about 1¼ tons, worth about Rs. 226. It is used principally for medicinal purposes, and, to some extent, as an article of food. There are said to be four kinds of bees: (1) *peddapera*, (2) *chinnapera*, (3) *tahteni*, (4) *musara*. The first kind alone collect honey in considerable quantity, their combs yielding on the average about 2 seers of honey (1⅔lb). These bees store their honey in clefts of inaccessible rocks. The taking of the honey is described as follows :—

"In order to extract honey from peddapera bees on rocky slopes, eight or ten men, who know all about them, proceed to the spot and draw honey during the day if there is only one hive there, or at night if there be two or three hives at one place. The mode of extracting is as follows :—A chain of bamboo sticks, strongly tied to one another, is fastened by three or four large ropes to a tree or peg on the summit of the hill, and let down into the cave. A few men at the summit catch hold of a rope tied to the waist of the man drawing honey, and also a leather basket and a stick (to press honey to fall into the bag) by means of two other ropes. The man drawing honey then ties a cloth to his head and body, and gets down the chain of bamboo sticks, in order to press the honey into the basket by means of the stick above referred to, when the men at the top burn a bundle of green leaves, grass, and firewood and sling it down by a rope to drive the bees by the smoke. The man in the cave then drags the honey into the baskets and is pulled out by the men at the top. If there be no trees on the top or a peg cannot be pitched into the ground, no endeavours are made to draw honey."

The season for taking honey is June and July.

II. *Cuddapah.*—The Cuddapah tehsildar reports the annual take in the Lankamalai and Paloonda Hills to be about 350 maunds.

The names of the four kinds of bees as given by him are as follow :—

Toonti-teni or bees in trees and shrubs ; *musara-teni*, bees in hollow trees ; *toli-teni*, bees in holes ; *pera-teni*, bees in rock caves.

III. *Proddutor.*—This tehsildar says the local supply is only about 15 maunds. The best sort of honey procurable in Proddutor bazaar comes from Bellary, and is worth Rs. 2-8 to Rs. 2-12 per maund. The local honey and that obtained from Kurnool is worth about Rs. 1-4 or Rs. 1-8 per maund. There are only two sorts of bees called *Peddapera* and *Toontu*. The former store honey in rock caves, and the latter in walls, hollow trees, &c. In taking honey the bees are driven out by smoke. The hives of the large sort are taken by moonlight.

IV. *Rayachoti.*—The tehsildar says that the Yanadies are the only caste who take honey. He gives the same classification of bees as that given by the Sidhout tehsildar. The annual take is about 20 maunds for the whole talook. The honey season is July and August, with a subsidiary one in November and December.

Extract of report from the Collector of South Canara, Mr. Sturrock :—

The marginal figures show the quantity and value of the honey exported from and imported into the several ports of this district during the official year 1881-82. The selling price of honey in the local market is about Rs. 10 per cwt. There is a large demand for it, as it is valued for its medicinal qualities.

EXPORT.

	Quantity. Cwts.	qrs.	Value. Rs.
For other than district ports	120	3	1,336
To district ports ..	23	1	197
	144	0	1,533

IMPORTS.

	Quantity. Cwts.	qrs.	Value. Rs.
From Malabar ..	4	-	40
" Goa ..	2		16
" district ports	20		176
	26	2	232

In connection with the remark in Board's Proceedings dated 16th February 1882, No. 516, that there are periods when honey is reported to be unwholesome on the Nilgiris, I may mention that two deaths from eating honey have been recently reported from the Coondapore talook. I have called for further particulars.

Extract from report from Mr. C. H. Mounsey, Acting Special Assistant Collector, to the Collector of Ganjam :—

The information I give is almost wholly derived from the report of the Udayagiri sub-magistrate, and from it you will see that very little, if anything, is done in trading in honey.

In the division four sorts of honey are obtained, called respectively *bhago* honey, *sathapuria* honey, *binchania* honey, and *nikiti* honey. I have been given the following particulars about them :—

Bhago Honey.—This is made by a large and fierce description of bee (hence the name), whose nests are only found on lofty trees and steep cliffs of rock. The inhabitants of Chinnakimedi dare not try to take this honey. In the Goomsur Maliahs it is obtained by tying dried palm leaves to very long bamboos, and in the night applying these leaves lighted to the nest. The bees are thereby driven away, the trees are climbed, the comb transferred to pots and brought down. If the trees are too difficult to climb, the nest is knocked down piece by piece by long bamboos. This is avoided, if possible, as the fall to the earth breaks the cells and the honey gets damaged. The honey is extracted by first cutting the comb to small pieces, and then squeezing the honey out. It is thick and very sweet, and is used for food, but it is no use as a medicine. The comb is very large and very full of honey. This kind and the next sort I shall mention are comparatively rare in these hills.

Sathapuria Honey.—Bees make this sort in hollow trees or old white-ant heaps. The bees are a smaller and less fierce kind than those which make the *bhago* honey. To obtain their honey, they are driven off with branches, and if their nest is in a tree, it is cut down ; if in an ant-heap, dug out. The honey is extracted as the *bhago* honey is. It is not so thick as that, but very sweet and useful for medicine. The cells also have a large proportion of honey in them, and the combs are large. They are built up in seven layers (but what each layer consist of I cannot find out) ; hence the name *Sath-apuria*.

The third and fourth sorts, though not very common, are by no means rare in this division.

Binchania Honey.—The bees that make this generally build their nests where smallish branches intertwine. A very large nest will not be more than a foot or so wide and long, and from such a nest only a quarter seer of honey can be obtained. It is a thin honey, not very sweet, but palatable. Its name is said to be derived from the fancied resemblance to the motion of a fan (*binchania*) in the nest as the branches it is built on sway in the winds. The bees not being fierce, the honey is taken in the daytime by lighting a fire underneath the nest, or beating the bees off with branches.

Nikiti Honey.—The fourth sort is found in cracks in walls and *pials*, between timber, or in holes in the ground. The bees are very small (hence the name I am told) and quiet, so much so that children collect the honey. Very little is obtained from one nest, and the eggs of the bee, they say, being bitter, gives the honey a naturally acid taste. The honey is good for eating.

The honey nowhere appears to be purposely collected for sale or barter ; but if the Khonds have a good find, having put aside what they want for their own medicine or domestic consumption (it is largely used to quiet children instead of jaggery), the remainder will be sold or exchanged for salt or other commodities at the markets.

Extract of letter from the Rev. E. Bonaventure, Roman Catholic Priest at Surada, to the Collector of Ganjam :—

From my arrival in India I have applied myself to find out some means for the introduction of domestic bees, considering this to be a great improvement in the general domestic economy of the great Indian family. Unfortunately, the few discoveries I succeeded in arriving at on the subject are more theoretical than practical. I don't know of any native or European having succeeded in introducing domestic bees in this forest region. But with the view to a small profit, the Khonds do not neglect the gathering of wild honey—abundant in their forests—to sell it in the bazaars, where it is consumed by natives, who seem very fond of it.

In this place people distinguish six sorts of wild bees. They are called *Oorinh* in (1) *Bagho Mohu Matchi*, (2) *Satopori Matchi*, (3) *Bitchinna*, (4) *Hatti Kanno*, (5) *Tankna*, (6) *Nikti*. Here are a few particulars about each one of those six species :—

(1.) *Bagho Mohu Matchi* (metaphorically or onomatophæically so called, because, say the Indians, it is terrible as a *tiger*) is about the size of our domestic European bee, a little longer, brown, and builds its combs on boughs of largest trees ; is approached at with difficulty, and gives but little hopes of being ever domesticated.

(2.) *Sattopori Mohu Matchi* (because it builds no more and no less than seven combs) makes its home in the earth, in the eaves of houses, or in trunks of trees ; is of a small size—not the smallest—and of a dark brown colour ; it does not seem annoyed at the vicinity of human beings, and could therefore be easily domesticated.

Some native people have made the following experiment, which proved, they say, to be successful :—Having discovered a swarm of "Sattopori" bees, they carefully remove the combs of the young nymphs, place them in an earthen pot, and after a few days, see the new bees working in this house as if it were their birth-place.

(3.) *Bitchinna* (make one red comb of a semi-circular form like a fan) ; (4) *Hatti kanno* (because of their one comb having the shape of an elephant's ear) ; (5) *Tankna* (one small comb having the form of the stone of a mosque)—Are three sorts of small bees of a very wild nature, build their houses on the boughs of trees, fear the vicinity of animated beings, and give but little hope of domestication.

(6.) *Nikti* (which means a small pair of scales), probably on account of the size of the bee and of the little quantity of honey given, is, in my opinion, the smallest bee observed in the country. It works in the trunks of trees or in the cracks of old walls. I now follow the work of a swarm of these interesting little creatures settled in an old wall near the Mission House in Surada. My intention is to prepare for them small hives and try (by still, I don't know what means) to domesticate them. If success answers my

attempt, it will be with the greatest pleasure that I shall report to you its results.

Extract of report from the Assistant Collector, Mr. A. E. C. Stuart, to the Collector of Ganjam :—

The low-country Khonds and Ooriahs that inhabit the wooded mutahs of Panchagodotolo, Birkot, Durgaprasad, Darpangia, Gidipaballi, and Sarabadi, at the foot of the ghats, as well as the more remote parts of Jaganuadhaprasad and Kurcholy, recognize six kinds of bees, which are locally distinguished as follows :—

(1.) *Bodabagho Mohu Matchi*, (2) *Sannobagh Mohu Matchi*, (3) *Satopuri Mohu matchi*, (4) *Binvdona Mohu matchi*, (5) *Tenko Mohu Matchi*, (6) *Nikiti Mohu Match*.

This classification is evidently based on the respective dimensions and peculiarities of these winged insects *(matchi.)*

Thus No. 1, being the largest and most formidable, is descriptively called "the big tiger-honey-fly" *(Bodabagho Mohu Matchi)*; No. 2, though almost equally dangerous, is somewat smaller, and is therefore distinguished as the "little tiger-honey-fly" *(Sannobagho Mohu Machi)*; No. 3, though less offensive, is larger than No. 4, from which it also differs in the fact that whilst its combs *(caco)* are arranged in seven layers (Sattopuri) tier upon tier, the honey *(mohu)* of No. 4 is contained in a pendent hive *(mohu cako)* attached to its support in the form of a fan (binchona); No. 5 owes its name to its peculiarly long wing coverlets within which, as it were, it has its abode *(tenko)*; * No. 6 is the most inoffensive and diminutive of all (Nikiti "the last of a series"). I regret that the want of books of reference of entomology prevents my attempting to identify these bees with well-known species elsewhere. It may be remarked, however, that the Khonds *above ghats* do not appear to discriminate so carefully between these different kinds, as I believe all bees are called by one name in the Hills "*(puki bee onga,"*—*i.e.*, "the honey *(puki)* fly *(beonga)*" and their hives "*pukigara.*"

The habits of these six sorts of bees, as far as they have been observed, are thus described :—Nos. 1 and 2 make their combs on the highest branches of the loftiest trees, and are only found in the densest parts of the jungle. They rarely remain in the same locality for more than three months, during which time they produce some ten or twelve (Ganjam) seers of honey.

Nos. 3 and 6 frequent hollow trunks of trees and crevices of rocks and walls, which they inhabit for periods of about two years. A season's outturn of honey averages twelve (Ganjam) seers, and being of superior quality, is highly prized.

Nos. 4 and 5 build on boughs of small trees and bushes, and are frequently found in gingelly crops. They appear to be of the most restless disposition, seldom remaining for more than forty days in one place, and consequently seldom yield more than two (Ganjam) seers of honey.

The quality of the honey of these wild bees is decidedly inferior to that of the domesticated bees of Europe, and at times even poisonous owing to the bees having resorted to noxious flowers.

No systematic method of bee-keeping has ever been attempted by the natives of my division, which, as far as I am aware, does not contain a single domesticated bee. I can see no reason, however, why an experimental bee-farm should prove unsuccessful. Melliferous plants and trees, such as the mahwah (*Bassia latifolia*) and kino (*Butea frondosa*), of whose flowers wild bees appear exceedingly fond, grow abundantly; and that honey and wax would be duly appreciated is beyond question, having regard to the fact that the demand in the market is even now sufficiently strong to induce hill and low-country Khonds to bring, from time to time, to Russulkonda, Bellugunda, Bodokodunta, and Surada, their uncertain upply.

The honey thus obtained is, after considerable adulteration, locally consumed, the total value of the sales being estimated at Rs. 2,000 per annum.

Though it is doubtless true, as remarked by the Board, that "much of the fertilisation of flowers that is done in England by bees is in India done by ants," I venture to suggest that it is equally true that much of the cross-fertilisation of plants in India as elsewhere cannot be effected by ants, but only by permanently-winged insects, such as bees.

Sprengel was the first to point out that the true function of honey was to secure cross-fertilisation by the attraction of insects; and Mr. Darwin has proved that to effect this desirable object, it is not only necessary that pollen should be carried *from a different flower*, but also *from a different plant*. Such transfers can generally only be made by winged insects as bees, which readily flit from plant to plant, and not by creeping insects, as ants, that of necessity crawl from flower to flower.

Moreover, Sir John Lubbock's investigations have shown that certain flowers, if not cross-fertilised by honey-seeking *winged* insects, could not be so fertilised at all, inasmuch as they have been specially protected by nature from ants that would merely steal their honey without compensating for the fraud by the involuntary gift of fertility,—a boon that could only be conferred by some such winged insect as the bee.

Thus, the marvellous *chevaux de frise* of spines and downward-tending delicate hairs that such flowers as the *carlina* and *lamium* bear, the glutinous exudations from the *limnœu*, and the slippery smoothness of certain pendulous flowers, are all typical examples of nature's protection for the perpetuation of these species.

As representatives of all these and many other similar species exist in India, it is manifest that the part played in their cross-fertilisation by such honey-seeking, permanently-winged insects as bees is far from inconsiderable.

The whole question of bee-keeping in India thus acquires not only commercial, but a scientific, interest.

Extract of report from Mr. W. S. Foster, Collector of the Godavery :—

"122. *Miscellaneous Products—Honey and Wax.*—There are five different sorts of honey produced in the jungles of this district,—(1) *kurra tench*, (2) *moosur tench*, (3) *tonudu tench*, (4) *pitwar tench*, (5) *kunagole tench*, (*tench* in Telugu means honey). Nos. 1 and 5 are the most delicate, the wax of both varieties is also good; the former is found in bushes and small trees, the latter in holes in the trunks of trees. The *kunagole* honey is scarce. The combs of both are removed by the hand: the bees do not sting. No. 2 is found in holes in trees, &c.: the wax is good. No. 3 is found in holes in the ground, white-ant hills, &c.; the wax is good. No. 5.—This is the honey of the large bee: it is found suspended in large combs from lofty trees and rocks: the bee is dangerous if disturbed. Honey is not exported, but the wax is collected by Gottehs and Koyas, and sold or bartered to traders, &c. Turmeric is sometimes used to give a yellow colour to the wax."

Mr. H. A. Sim writes from Kurnool :—

The only variety of bee that is known to exist in this district is the large one that builds its combs in great masses on the faces of cliffs or in crevices among the rocks. The Nallamallis are its chief habitat, and the honey is there gathered by Chentsus, and by them sold to the nearest Comaties in exchange for grain or other necessaries, at the rate of 6 or 8 pies a bottle. It is eventually retailed in the outlying Cushbah villages at 4 or 5 annas, or in Kurnool itself at about 8 annas a bottle.

It is also found in the Yerramalais; the professional honey-gatherers there being a few men of the Boya and Wadder castes, belonging to Paniem and Tamaraspalli villages.

The honey has a slightly bitter flavour, but is otherwise perfectly clear and good, while the wax is white and firm; the hot-weather is said to be the time for taking it, but I have had no difficulty in getting it in the cold weather as well, and it is probably taken all the year round.

I can give no information as to the quantity produced: it can hardly be very much; but such as it is, it finds a ready sale, and there would probably be a large demand for imported honey if it could be sold at a reasonable price.

The mode of harvesting differs slightly in the two places. The Chentsu, who has to deal with the comparatively high precipices of the Nallamallais, lets himself down from above by means of a sigle continuous line of bamboos, tied together with strips of fresh Madapu bark, and with a long stick in his hand sweeps the comb off the cliff into a cloth that is hauled up by his comrades above. These men are of course excellent climbers and seem to disregard the bee-stings. The Paniem Boya, on the other hand, has only to work among the low cliffs of the Yerramallais; he, therefore, climbs up from below, and, first taking the precaution to smoke the bees off he slashes the combs right and left with his knife and catches the liquid honey as it falls in the large sack-like leather cap that he wears.

Extract of report from Mr. F. E. Robinson, in charge of the Madura Forests, to the Conservator :—

In this district about 10,000 measures of honey are consumed yearly, of which 3,000 are produced in the district, both from Government and private forests. The remainder is imported from Tinnevelly, Coimbatore, Salem, and Bangalore districts. About half the consumption is in the Hindoo temples. The honey is sold in the market between As. 14 and Rs. 1-4 per measure.

Bees are not domesticated in this division. Wild bees make their combs on rocks, boughs, and sometimes in the eaves of houses, and honey is gathered therefrom by wild tribes and by Valayers, &c., by the aid of smoke and ladders made of creepers, &c.

The following kinds of bees are found in this district :—

(1.) *Perunthanee* or *Malaithanee*, a large bee with body of a fulvous hue, segments blackish, and wings dusky; body 1·0 inch long. Makes thick honey, which is dark white streaked with red or black. The comb is two feet by one foot, and is found under cliffs at high altitudes, and yields about two measures of honey. It stings severely.

(2.) *Seruthanee* or *Puthu ance* or *Kombuthanee*; body 0·7 inch long. Found in holes of trees on plains and low hills. The comb is small, yielding scarcely more than one-sixteenth measure of honey.

(3.) *Ponthuthanee* or *Thoduthanee*; length 0·6 inch. Found in holes of trees and plains, often in clusters. Yield about half measure of honey and half pollum wax.

(.4) *Kosuvanthanee*; body 0·3 inch long, very tiny. Seen near foots of hills, and yield scarcely one-sixteenth measure of honey, but one and-a-half pollum of wax.

Mr. V. A. Brodie writes as follows to the Conservator of Forests from Malabar—

I have the honour to report that the practice of bee-keeping is quite unknown to the natives of Malabar.

The wild bees construct their nests on or in trees or rocks difficult of access in the months of February and March, which is the period when the trees of all descriptions flower in this division, and the Mulcers (hillmen) take the honey in April and May before the rainy season sets in. It is roughly estimated that not less than 200 paras of honey are collected from the Government and private forests situated in my division.

There are two kinds of bees, one large and the other small. The larger kind produces a large quantity of honey, locally called *Peruthaue* and also wax. This honey is not considered so good as the honey produced by the smaller sort of bees, which is called *Seruthane.* In quantity the latter is comparatively very small, and is considered to possess medicinal properties.

From some places, such as Alathoor, Vadakancheri, &c., honey and wax are carried by Moplah merchants to Calicut and other places for sale.

In a further letter he writes—

Habits.—I do not know whether they hybernate during the monsoon or not, but will endeavour to find out. It is difficult to get any information respecting their habits (*e.g.*, do the young bees collect at the mouth of the old hive before swarming? In what months do the young bees swarm? &c.) from the Mulcers, as they

apparently pay no attention to such details, and when he finds a nest in the honey season, a Muloer promptly rifles it. I will, however, endeavour to get some information on the subject at the time of the jummabundy settlement.

As in Malabar, or rather in this division, there is an abundance of flowering trees and shrubs, &c., I should think the introduction of bee-culture would be a success if once effected. The domestication, however, of the indigenous bee is not likely to be effected, even if feasible, save by the employment in the pursuit of some one with practical experience of the habits of bees, &c., in other countries or districts. The climate of this coast is so peculiar that I doubt whether foreign bees could be introduced.

Extract of a letter from Mr. Lee-Warner, Acting Collector of Nellore :—

I hear that three varieties of honey-producing bees are known in this district.

Rock-bees, Telugu. These bees are dangerous, and their honey can only be collected with great precautions. They are attacked in the night time by a man who is let down the rocks from above, until he is level with the place where the nest has been marked in the day time. By the light of a torch this man places a bucket at the end of a pole underneath the nest. He then pokes two or three holes in the comb; and the liquid honey comes down into the pot placed below. One pot and sometimes two pots are collected in this way from a good nest, and the honey is sold at four annas a viss to the merchants in the neighbouring villages. There are two seasons for collecting the honey in this way—first in April, when the Beera is flowering. This is the best honey. The second season is in November, when the bees feed on the flower of the Cactus (*Bonta jemudu*, Tamil *Sadarakalli*). This honey is very hot. I am told that there absolutely no means exist of domesticating this variety of bee.

Pulla Tena.—This bee makes a small comb on trees. It is half the size of the rock-bee and not so dangerous. Its comb is easily robbed by knocking it off the tree, after the bees have first been frightened away by noises made under the tree. It is a better sort of honey than the rock-bee honey, but is not collected in such large quantities.

A bee, the size of a fly, called *Koshoovu* in Tamil, Telegu. This bee generally makes its comb in the hollow of trees, and has a very small comb. The honey does not taste nice, but is greatly used for medicine in cough, fever, and such cases.

I have obtained most of this information from the Wood Overseer, who knows more about the subject than any of the persons in the district. He is strongly of opinion that the bee indigenous to the district cannot be domesticated. It also has to be observed that the common people among the Sudras have a superstition that the settlement of bees in their backyards is portentous of some evil happening in the family, and it is possible that, for the same reason, they would not regard bee-keeping in the domesticated state with favour.

The Superintendent of the Government Gardens, Ootacamund, writing to the Collector of the Nilgiris, says :—

A few years ago I managed to keep a swarm of Nilgiri bees in a deal-wood box for about three months by feeding them on sugar and water. But they did not appear to be at home in the box, and apparently consumed the honey as they collected it, as there were only a few empty combs in the box when they left it.

The Collector also forwards a letter from Miss Cockburn, of Ketagiri, Nilgiri Hills, to the Acting Head Assistant Collector, from which the following is extracted :—

There are three kinds of bees on these hills, the largest being about an inch in length, builds in almost inaccessible rocks and forest trees, and makes immense hives of three or four feet in depth. These hives are occasionally taken by the Curumbers and Irulars (the wildest aborigines of these hills), who anoint their bodies with the juice of a leaf which grows wild, and which the bees cannot bear. They then let themselves down from the top of the rock with a rattan rope, and after sweeping the bees away, take the whole hive, as they consider the part containing the young bees a great delicacy. Many years ago a gentleman had a very narrow escape, having been chased by a hive of these large bees while out riding. He dismounted and laid down in a swamp, when the bees left him and attacked his horse, which died from the effects of the stings, two or three days after.

The second species of bee is much smaller, and only hives in holes in rocks and trees. We have had this kind in boxes for many years, and found that they succeed well, especially if the garden is well stocked with flower-plants, when they become attached to the locality, and will never leave it. When a hive of this class of bees has been disturbed, they generally cluster on the branch of a tree near till a new abode is found. In such cases, if a common deal-wood box with a little honey spread on the *inside*, and a small hole cut out at one side, is turned down on a board and placed near the hive, the bees generally find their way into it, or they may be swept into the box at night, and the box replaced on the board. In about a month or so, there should be several combs of honey. All may be taken except *one*, which should always be left to induce the bees to remain. In the hot season there should be some protection (a little straw or anything placed over the boxes, to prevent the heat of the sun melting the honey-combs as it has been known to do.

The third species of bee is *very* small and only hives in bushes, and will not remain in a box.

Once in seven years, when the Ruellia is in blossom all over the hills, the honey is very dark, and not considered quite wholesome.

The price of honey here is 12 annas or 1 rupee a bottle.

From Tanjore the Collector writes :—

Three sorts of bees are reported to be found in this district, called the (1) *Kothuudi*, (2) *Kolavi*, (3) *Kosahu*. The first is said to be black in colour and irascible. It makes its combs in rocks and trunks of trees. The second sort is generally inoffensive, though it is possessed of a sharp sting, and is red in colour. It builds on boughs, in the eaves of houses, and in trunks of trees. The third is of a diminutive size, and may probably be domesticated.

As regards their domestication only a single instance has been reported. The zemindar of Singavanam, in Pattucottai talook, on information received in regard to bee-keeping in Colombo and the Mauritius, obtained a queen-bee and tied it to a stick by a thread and placed it in the hollow of a tree, and after two or three months a piece of honey-comb, about the size of an egg, was found to have been made by the bees which had been attracted there. The experiment was then abandoned. There seems to be none in this district who are interested in the matter.

Little is known regarding the habits, &c., of these bees beyond the fact that the honey is gathered two or three days prior to the new or full moon. The largest quantity is obtained in the Kodiakadu jungle, Tiruturaipundi talook, and is sold at 8 annas per measure. It is chiefly used for medicinal purposes and not as an article of food. Whatever quantity is produced is consumed within the district and none is left for exportation. On the other hand, a certain quantity is imported from Ceylon whenever there is a demand for it.

Mr. W. C. Hayne, Deputy Conservator of Forests, Tinnevelly, has been at great pains to obtain information. He writes as follows :—

The quantity of honey collected from the Tinnevelly forests per annum has varied from 60 to 800 measures, or 45 to 600 Madras seers. It is sold in retail and wholesale.

The profit realized varies from 4 to 8 annas per measure, or 3 to 6 annas per Madras seer, or 4 annas per quart bottle.

None is exported that I am aware of, but is all consumed in the following ways : eaten largely at marriage festivals, as an offering or for anointing gods in heathen temples, and much employed in mixing with medicines.

It is not known how much honey is of a superior quality, as various combs are mixed together at the time of collection.

There appears to be a fair demand, and some is imported, I learn, from the Madura and Palghat hills.

(To be Continued.)

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Thursday, the 5th January, 1883.

W. H. Cogswell, Esq., *President, in the Chair.*

The Proceedings of the last (November) Meeting were read and confirmed.

The following gentlemen were elected members :—

Managers of the Sungma Tea Association, Darjeeling; of Woodlands, Cachar; of the Nonai Tea Company, Assam; of the Otter Indigo Concern, Tirhoot; and of the Equitable Coal Company, Seetarampore; Major R. Bartholomew: Major Duncan G. Pitcher; Sheikh Gholaum Moheed-ood-deen; his Highness the Nawab of Jaora, and his Highness the Raja of Nursinghur, Bhopal.

The names of the following gentlemen were submitted as desirous of joining the Society :—

F. D. Bellew, Esq., Senior Master Pilot,—proposed by Mr. R. M. Daly, seconded by Mr. J. E. MacLachlan.

S. R. Elson, Esq., Senior Master Pilot,—proposed by Mr. R. M. Daly, seconded by Mr. R. Blechynden.

J. Leadbeater, Esq., Ranikhet,—proposed by the Raja of Kantil, seconded by the Secretary.

Maharaja of Mohurbhunge,—proposed by the President, seconded by Mr. G. L. Kemp.

Contributions.

1. Suggestions regarding the demarcation and management of the Forests of Kulu. By Dr. Schlich. From the Government of India.

2. Memoirs of the Geological Survey of India,—*Palæontologia Indica*, Ser. XII, Vol. IV, Part 1, and Ser. XIII.

Records of Ditto, Vol. XV, Part 4.

Memoirs of Ditto, Vol. XIX, Part 2. From the Government of India.

3. A Manual of the Land and Revenue Systems and Land Tenures of British India. By Baden Powell. From Government of India.

4. Proceedings of Asiatic Society of Bengal, July and August 1882. From the Society.

5. Proceedings of Agri-Horticultural Society of Madras, November 1882. From the Society.

6. *Tropical Agriculturist* for December 1882. From the Editor.

7. Field and Garden Crops of the N.-W. Provinces and Oudh, Part 1. From Government of the N.-W. Provinces.

8. A collection of Geranium plants. From Mr. W. Gollam.

9. Two fine plants of Magnolia Grandiflora. From Mr. C. Nickels.

Garden.

A report from the Garden Committee was submitted. The Committee intimate they have arranged for an Iron Plant House, to be commenced at once. They allude to the recent consignment of Roses from Messrs. Paul and Sons of Cheshunt. Those despatched in Wardian cases had proved a failure; the larger quantity in closed wooden boxes had succeeded much better.

The usual monthly report from the Superintendent was also submitted, of which the following are extracts :—

"The garden has been further cleared of useless plants, but there is a good deal yet to be done in that way. A new ornamental plant catalogue is being prepared, and will be issued in due course ; in the meanwhile members desiring a few, but choice plants in their allowance, may have the same by visiting the garden and making their own selection.

"*Eucalyptus citriodora* has taken very kindly to Bengal, and being sweeter scented than *Aloysia citriodora*, 'sweet scented Verbena,' besides growing to a good size, ought to make it a very popular plant, and one that no house should be without.

"The potatos kindly supplied the garden by Mr. W. Stalkartt have been planted and look very promising ; by next meeting I hope to be able to report fully on them.

"The Iron Plant House, now in course of erection, will be found very useful for members and others selecting plants, as being massed in lots, a glance will show what is available.

"I shall in the course of a few days send up to Secretary's Office *Reana luxurians* and *Bahmia Cotton* seed ; a fair supply of the former has been collected, and the latter is being gathered.

"The shade thrown by *Oreodoxa regia* has had a peculiar effect on a bed of Rose plants, all within its range having suffered, and to all appearance died down. On removal of the *Oreodoxa regia* the Rose plants recovered their vitality, and I have every reason to believe will do well ; this may be worth enquiry, as *Oreodoxa regia* does not appear to have a baneful effect on other plants."

Results of Experimental Cultivation of Kumaon Potatos in the Darjeeling District.

Read a letter, dated 8th September, from the Secretary, Government of India, Revenue and Agricultural Department, requesting to be furnished with a report on the above potatos, of which a supply was given in February last.

Read the following letter, dated 2nd December, from Mr. H. J. Leitch (Messrs. Lloyd & Co.) in respect to the above :—

"With reference to your letter of 15th September last, enclosing one from the Department of Agriculture and Commerce, regarding the sample potatos handed to me for distribution in the Darjeeling district, I have now the honour to forward the reports I have received from the different planters in the Darjeeling district, to whom I entrusted the samples for experiment. I can only express my regret personally that the results have not been more satisfactory."

From Mr. W. Helps, Singbala, 12th November, to Mr. H. J. Leitch.—"Your favour of 7th instant to hand, have written to the following gentlemen for their reports on the potatos I sent them, and immediately on receipt will forward on to you :—

Mr. H. R. Irwin	... Punkabaree	... 1 bag.
,, A. E. Allies	... Ring Tong	... 2 bags.
,, A. C. Curtis	... Ting Ling	... 2 bags.
,, C. G. Reid	... Murmah	... 3 bags.
,, J. C. Horn	... Nahore	... 2 bags.
,, S. Smith	... Teesta Valley	... 2 bags.
,, H. W. Craigie	... Gielle	... 2 bags.
,, E. Ephgrave	... Selimbong	... 2 bags.
,, G. F. Flamsteed	... ———	... 20 seers.
,, F. A. Wearing	... Ambrotia	... 20 seers.

"The remainder was put down by me on land belonging to the new Fallodhi Tea Co., Ld., at an elevation of about 4,000 feet, with exception of about 20 seers, which I planted in my vegetable garden at an elevation of about 3,350 feet.

"Owing to the lateness of the season for planting potatos in the Terai, and the receipt of your private note without date, the instructions contained in Messrs. Lloyd & Co.'s letter of 9th February last for the distribution could not be carried out, so that, in consultation with the late Mr. Forbes Hall, the within mentioned list was agreed to instead. Several wealthy natives of the district were asked to plant some of the potatos as well, but I regret to say, not one of them cared to do it, or seemed to take the slightest interest in the matter at all."

Report on Potato seed received from Messrs. Lloyd & Co., Calcutta, as per their letter of 9th February 1882.

"*3rd March* 1882.—Planted in my vegetable garden at about an elevation of 3,350 feet, ten seers of small tubers in trenches well prepared with ashes, lime, and manure, each trench about 2½ feet apart, and potatos sown about eight inches apart, the tubers were very small with all eyes but one picked out, nearly every one sent up vines, which grew exceedingly well, and formed good substantial looking plants, necessary earthing up was done, and when the whole of the vines had completely dried, were dug up in the month of July, result being only 20 seers of very poor, indifferent small potatos ; any number of the vine roots being taken up, without the slightest sign of a tuber having been formed. Red ants very destructive.

"Planted in my vegetable garden at the above elevation ten seers of the largest size tubers cut into four and five pieces, put into well-dug-deep trenches, manured last year with cowdung, and in which nothing had been grown since it was manured, soil was beautifully prepared, pulverized, and forked deep to about one anda-half feet ; dug up in July, result about thirty seers, not one of the tubers being equal in size to what were planted, as with the small ones ; any number of the vine roots not having the slightest sign of a formation on them whether from having been in a very young state, destroyed by red ants, or not, I am unable to say, but I find them (red ants) very destructive up at this elevation, and do all I can, I cannot rid the place of them, for I have burnt the soil, used ashes and lime to a great extent and still of no very great beneficial avail. March 4th, 6th, 7th, 8th, 9th, and 10th, planted nine maunds one seer at an elevation of about 4,000 feet, putting some down whole, some cut into four and five pieces, and some treated as the small tubers were planted on the 3rd in my vegetable garden. The land selected had not been cultivated for some six years past, a rich red looking soil, cut the jungle on it first and allowed to dry, then fired it for the ash, deep-hoed it once, and then sprinkling well with lime, forked it deep, taking out all roots, stones, &c., and pulverizing the soil as much as possible, planting the potatos on drills as is the native custom up in the district, earthing up as well and not a weed allowed to grow, for one coolie was kept constantly on the field for this purpose, and also to protect it from being robbed at night, it was strongly fenced round also, to keep animals and cattle out, and I should say the land planted out was from ¾ to an acre in extent. On being dug up in September, many tubers were found to be half-rotten, and many more had thrown out new vines four to five inches long ; this, I am inclined to think, shows that the elevation there is not suited for potato growing, and seems that it is neither one thing or the other. Root upon root was dug up, without a single formation of a tuber, and any number of others with only one tuber, in which case, it invariably was a fairly large one, with a red skin ; some of the white skin roots gave five and six tubers, but only one could be called medium size ; result of produce about twenty-seven maunds, or about three maunds for every one maund planted, which is a very poor yield indeed, and plainly convinces me that potatos will not grow well unless in a soil that retains moisture, and in a medium temperature, and at an elevation of about 5,000 feet or so when planted in February or March, or on the plains in September or October, when there is a very good amount of forcing heat and a good amount of moisture in the soil retained after the closing in of the rainy season to assist the development of the tubers after forming. I have experimented up here now for the last six seasons with potatos, and signally failed each year. In all other ordinary garden produce I have been most successful, which convinces me that I am not altogether to blame for the failure, but that the elevation and soil is not suited, and would *never* pay to cultivate the potato, no matter if the very *best* seed *possible* could be procured and planted.

In conclusion, I can most conscientiously say that I devoted a great deal of time and attention to the preparing of the land and the planting of these tubers, but regret exceedingly the thing has turned out so miserable a failure.

From Mr. H. M. Leonard, Goomtee Tea Co, Ld., Kurseong, 14th September 1882.—Yours of the 9th February, anent cultivation of potatos, to which I replied on the 14th February 1882. I distributed the potato seed amongst some of my people, and also planted a quantity under my own supervision, but found nearly in every case that the seed rotted and in other cases yielded but a poor crop, of small waxy potatos, the size of bullets. The accompanying figures will show the percentage of some of the seed planted, *viz.*, from 20 seers seed 80 seers potatos all very small, and from 16 seers seed 40 seers potatos also small, and fully half were rotten and not fit for use.

From Mr. E. Ephgrave, dated Selimbong Estate, Nagrispore, 14th November 1882.—Your post-card to hand. The two bags of potatos you sent to me were in very bad condition, many of them rotten, evidently through being confined in the bags too long, consequently only 90lb. were fit to sow, which produced, as near as I am able to ascertain, about 470lb. Soon after they were sown I left for England, and the party I left in charge did not take any account or trouble with them. I have been given to understand they were greatly eaten by insects, but I did not see the potatos myself.

From Mr. G. F. Flamsteed, dated Nahore, 19th November 1882.—Here is the Rev. Wilson's report on the potato seed I gave him.

The bag of seed was in a very advanced stage for sowing, and yielded 27 seers for sowing only ; produce close upon 3½ maunds, not very large or small ; quality good ; these I have saved for seed, as the first time is no criterion.

From Mr. A. C. Curtis, dated Ting Ling, 12th November 1882.—In reply to yours of the 10th about the potatos, I am sorry to say they were a failure with me : most of them were destroyed by red-ants before they came to maturity.

From Mr. F. A. Wearing, dated Ambrotia, 13th November 1882.—I duly received your post-card and here is the answer.

I gave some to a sirdar, who planted them at about 4,000 feet elevation at the time you gave them, and they came up fairly well. I really cannot tell you the exact kind of soil, though I suppose it might be called a light clay.

Others I planted down near the Jorah that runs through our garden in first class soil, but it is too wet for them to succeed so low in the rains, and though some came, the majority rotted. I have planted another crop just at the close of the rains, and I think they should do well.

From Mr. S. Smith, dated Teesta Valley Tea Company, Limited, Darjeeling, 21st November 1882.—In reply to yours of the 10th instant, regarding the seed potatos which I received through you, I beg to state that I planted out some of both kinds on after their arrival (the 23rd February); this seems to have been too late in the season for this place ; the weather by the time the potatoes showed above ground, had become pretty hot, causing too rapid growth. The stems produced were enormous in size, and the tubers were both large and abundant, but the rains were on us before they were ripe, so that on digging up a plant, only about one-third of the tubers were fit for use, the larger ones were rotten, and the smaller unripe. I have no doubt had they been planted from six to eight weeks earlier they would have been an enormous crop.

On one plant (the white kind) I counted no fewer than 66 tubers : the average return was about ten times, but had they been ready before the rains set in, it would have been nearer twenty.

The quality of those fit for use was excellent.

Resolved—That the best thanks of the Society be given to Mr. Leitch for the trouble so kindly given towards this trial.

INTRODUCTION OF CERTAIN FRUIT TREES INTO THE FIJI ISLANDS.

The following interesting letter from John B. Thurston, Esq., Colonial Secretary at Fiji, dated 10th October, was next read :—

"I have to acknowledge with many thanks the receipt of your note dated the 28th June, together with a case of mangoes and lichees per ship *Poonah*.

"Your communication would have received earlier reply but for the unusual pressure of my official business, consequent upon the removal of the seat of Government from the island of Ovalau to that of Viti Leon.

"It is with pleasure that I now am able to inform you as to the results of your kind and very valuable donation.

"The lichees, with two exceptions, were all alive. They have been planted out in appropriate situations, and are in a fair way of establishing themselves.

"A few lichees had been previously introduced by planters returning to the Colony *viâ* Ceylon, but I am not aware that they were established in any one case. The same may be said of Rambutan, Longan, &c.

"You are probably aware that a congener of the lichee, *viz.*, Nephelium pumatum, is indigenous to Fiji. It is a very fine tree, and bears a very agreeable fruit. But you have it, I believe, in many parts of India. [Not in the Society's Garden.]

"Of the mangoes, a fair proportion were alive. Those dead were as noted in the margin. The plants had experienced some very cold weather, and had, I think, suffered a little from the not uncommon mistake of being supplied with too much water. Upon the whole, however, Mr. Cornelius landed his charge in very fair condition, and has well earned my thanks.

"The names in the margin are most likely improperly spelt, there being much difficulty in reading some of the labels, but may serve to indicate the varieties lost.

"In consequence of the early departure of Mr. Cornelius to his post at a somewhat distant part of the colony, I was unable to consult him as to what plants in this colony would be acceptable to your Society.

"But until he has been here some little time, it is not likely that he would have, upon such a point, much advice to offer.

"I shall therefore fill your case for return per 1st January, and ship in May next, exercising my own discretion as to its contents, though in the meantime if you can give me any suggestions yourself, it will give me pleasure to act upon them.

"This colony appears to present conditions of soil and climate favourable to the growth of a number of tropical productions, and with the assistance of the older colonies and dependencies of the Crown might soon possess them.

"Dr. King has very kindly sent me from time to time a number of trees and seeds of economic value, and they are doing very well.

"With the present rapidity of steam communication, I find, however, that the post is a most useful agent, as by the transmission of fresh seeds the probabilities of a useful introduction are increased, and the risks to individual plants avoided.

"If, therefore, it is within the power of your Society to send me seeds of any useful fruit or timber trees, or of any ornamental plants, it will confer a benefit on this young colony.

"I have succeeded in obtaining a grant of land, or rather a reservation, for the purpose of forming nurseries and gardens for the propagation and culture of useful and ornamental plants and trees, the management and control of which I have undertaken myself until such time as the finances of the colony will permit of a professional officer being appointed.

"Sir Joseph Hooker and Mr. T. Dyer have both taken great interest in the task I have set myself, and will learn with pleasure of the valuable and quite unexpected assistance you have been so good as to give me."

Resolved—That the acknowledgments of the Society be tendered to Mr. Thurston for his interesting communication, that a supply of seeds be forwarded to him, and that his offer of reciprocation be thankfully accepted.

JAPAN PEA.

Read a note from the Superintendent of the Botanic Garden, Saharunpore, forwarding a small paper of the Japan pea (*Soja hispida*), and promising a larger quantity on receipt of a supply shortly expected from Japan.

The Secretary stated that this pea has been brought to the notice of the Society some 38 years ago, as the following extract from its proceedings for August 1844 will show. A correspondent (Captain Bigge,) presenting an assortment of seeds from China, makes the following remarks in regard to one kind, which is doubtless the *Soja hispida* :—

"Of the esculents the large white pea is deserving of this notoriety, that it forms the staple of the trade of Changhair, or nearly so, to the astonishing amount of 10 millions of dollars, or 2½ millions sterling. This I give on the authority of the Rev. Mr. Medhurst of Changhair, and Mr. Thom, H. M.'s Consul at Ningpo. The peas are ground in a mill and then pressed, in a somewhat complicated, though as usual in China, a most efficient press, by means of wedges driven under the outer part of the frame-work with mallets. No description would suffice without a drawing. The oil is used both for eating and burning, more for the latter purpose, however, and the cake packed like large Gloucester cheeses, or small grindstones in circular shape, is distributed throughout China in every direction both as food for pigs and buffaloes, as also for manure."

BEE-KEEPING.

Read the following note from Mr. John Douglas in continuation of the subject introduced at the last meeting :—

"I am exceedingly obliged by your letter of the 21st ultimo, granting me every facility for cultivating bees at the Society's Nursery Gardens, Alipore, and I hope to be able to avail myself of the facilities so obligingly offered at an early date.

"I am endeavouring to obtain swarms of the large native bees, particularly of *Apis dorpatas*. I should feel greatly obliged by any assistance towards this object which any member of the Society may be pleased to afford.

"I may mention that Apiculturists in Europe are exceedingly anxious to obtain this bee for trial, and I have arranged to send a swarm to the British Bee-keepers' Association for trial.

"It may interest you to know that of two queens and three swarms of Italian bees, I have succeeded in saving two swarms, which are now breeding, and one queen."

From Dr. John Anderson, Superintendent, Indian Museum, applying for information regarding the keeping of bees by natives of this country.

The Secretary mentioned he had afforded such information as was possessed by the Society.

PROTECTION FROM WHITE-ANTS.

Mr. Marshall Woodrow, Superintendent, Botanical Gardens, Gunesh Khind, Poona, gives the following as an antidote for white-ants :—

"Perchloride of mercury, as its name implies, is a compound of chlorine and mercury. It is a heavy white crystalline substance soluble in water, and very poisonous. It is procurable from any chemist in a large way of business. This substance has been in use during many years among botanists and other naturalists to protect their specimens from insects, and recently has been tried with success against Whiteants.

"To use the perchloride of mercury it should be dissolved in water and the papers to be preserved dipped in the solution. Glass or glazed-ware vessels only should be used to keep the solution. As some officers meet with a difficulty in getting this substance, a small quantity has been prepared at this office for distribution. It is packed in small packets, each sufficient for one quart bottle of water, and these packets are enclosed in a paper bearing directions for use and containing one dozen packets."

COMMUNICATIONS ON VARIOUS SUBJECTS.

1. From Captain Pogson, furnishing some information in respect to *Pyrethrum* as an insecticide :—

I see by the proceedings of the Society for September last, that information is desired on the subject of the *pyrethrum*, and I trust that given on the other page will suffice. The *pyrethrum* is much used as a bedding foliage plant, and does not grow much higher than 18 to 20 inches at Kotegurh. The *Chrysanthemum* is from 2½ to 4 feet in height at Simla and Kotegurh. The native name for the plant and flower, is "Gooldaoodee," or David's rose.

There are five varieties of *pyrethrum*—one, 2 feet high, two of 3 inches each, and two of 6 inches each. These four are invaluable for bedding : all four are called "Golden feather," the old name being "Fever Few."

I should say a solution of carbolic acid, applied through an "atomizer" or spray-producer, would destroy the red-spider, and anything else in the insect line. It does so in America. Tobacco water may be similarly used.

No. 1, *Pyrethrum parthenium* (Linn). "Common Fever Few."—Flower of disk yellow, of the ray white. July. Perennial.

"The whole plant is bitter and strongly scented, reckoned tonic, stimulant, and anti-hysteric. It was once a popular remedy in ague : its odour is said to be particularly disagreeable to bees, and that these insects may be easily kept at a distance by carrying a handful of the flower heads."

No. 2, *Pyrethrum Tanacetum*.—"Leaves stomachic, cordial, cephalic, uterine ; seeds vermifuge." Flowers not described. (South of Europe).

No. 1 grows perfectly in Simla and Kotegurh. The leaves are pale yellow with a greenish tinge. Flowers in July, August. Seeds freely. Won't answer in the plains. A foliage plant as well.

Chrysanthemum coronarium (Linn.), Garden chrysanthemum. South of Europe. Flowers used to discuss steatomatous tumours.

No. 2, *Chrysanthemum segetum*, (Linn). Corn chrysanthemum. Flowers yellow. June to August. Annual. Cornfields. Discussive and attenuant when used externally ; and given against the jaundice, asthma, and shortness of breath.

2. From Under-Secretary, Government of India, Revenue and Agricultural Department, enquiring for information in respect to sand-binding plants. Complied with.

3. From the same, forwarding a model of the "Mexican aloe fibre-extractor," referred to in the proceedings of the last meeting.

4. From Messrs. Balmer, Lawrie & Co., requesting full information in respect to the cultivation of the aloe plant. Complied with.

5. From J. Clarke, Esq., Melbourne, acknowledging receipt, in fair condition, of a case of orchids in exchange for ferns.

SELECTIONS.

MR. ROBERTSON ON "TILLAGE AND PLOUGHS."

ON the evening of Wednesday, December 13th, a lecture was delivered in Bellary by Mr. W. R. Robertson, Agricultural Reporter to the Government of Madras, on "Tillage and Ploughs." Mr. H. P. Gordon, the Collector, was in the chair. The lecture was delivered in the large room of the Warlow Institution. There was a large attendance of the general public, including many landowners and ryots from the surrounding neighbourhood.

Mr. Gordon, on taking the chair, pointed out that the presence of Mr. Robertson at Bellary was due to a desire on his part to

learn something, definitely, regarding the results of Mr. Sabapathy Mudaliar's great enterprise in introducing so extensively superior European ploughs into the district. After noticing generally the very creditable manner in which this new enterprise had been started, Mr. Gordon introduced the lecturer.

Mr. Robertson spoke as follows:—My visit to Bellary on this occasion is, as Mr. Gordon has stated, chiefly in connection with the agricultural reforms instituted by Mr. Sabapathy Mudaliar. I have come to see what Mr. Sabapathy Mudaliar has effected, and to learn how far his example is being imitated by others. It was thought that I might with advantage give a short lecture in this town on Tillage and Ploughs; these subjects being of special interest at present here. Before proceeding to refer to ploughs in detail, I shall first bring under your notice some general facts referring to tillage. And first, I would remark that you may till a soil without making use of a plough; indeed, strictly speaking, the soils of Southern India are not ploughed. The implement generally used by our ryots, which is called a plough, is really what is termed a cultivator, being without a mould-board for receiving and turning over the soil. Most persons are aware that the productiveness of land is greatly stimulated by the soil being stirred, loosened, and turned by tillage implements. Land that is left untilled produces only vegetation of a very low order. It is true that, on such land, trees are produced without the soil being tilled; but trees, generally, require several years, and some kinds many years, to reach maturity; while, as you know, most of our cultivated crops must be sown, grown and harvested within a period of less than half a year; it stands to reason that if the plant you desire to cultivate has a very short life, it is expedient that it should be maintained in the fullest possible vigor during its period of growth, in order that it may be fully developed and matured; and this development will depend very largely on the amount of available plant food within the reach of the roots of the plant. I must remind you that plants, like animals, need food, and that it is no more possible for the plant to live without food than it is for an animal to do so. Again, you must remember that animals possess the power of moving about to search for their food; while plants are fixed in the ground, and though, to a certain extent, they do spread their roots in search of food, this power is but limited. It is therefore highly necessary that you should place the food of plants in close contact with their roots. In referring to the food of plants, I should point out of what this consists. Soils are composed of various mineral and organic matters; the former are sand, clay, lime, potash, soda and several other substances. A good soil contains a fair proportion of all these, which are called the mineral constituents of the soil; the organic substances are composed chiefly of the remains of plants which have become partly decomposed. It has been ascertained by examining, by analysis, great numbers of samples of each variety of field produce, that crops differ in their demands on the food yielded by the soil. One variety of crop feeds largely on potash, and will not thrive in a soil in which there is a deficiency of this mineral; another variety of crop feeds largely on lime, and cannot thrive without lime in the soil; while another must have soda, and so on. You will readily understand that if a crop which feeds on the lime is grown continuously on a piece of land to which no lime manure is added, that crop must in time find less and less lime in the soil, and therefore the power of the crop to become fully developed is lessened year by year, until, eventually, if the cropping is continued, the soil will be unable to yield an outturn of the crop sufficient to repay the expenses of cultivation. When a soil has thus been reduced in the scale of fertility, it is said to be exhausted. Of course, it is not absolutely exhausted, for it may contain appreciable quantities of lime, and other mineral matters, but yet not in sufficient quantities to admit of a paying crop being produced. When land is in this state, it is usually abandoned by the ryot, and, after remaining uncultivated for a number of years, it is probably agained resumed for cultivation, and, not unlikely, will, for some years again, yield such crops as will satisfy the ryot. The explanation of this restored fertility is, simply, that the soil has again replenished its store of available plant food; which was nearly all used up, when it became necessary to abandon the land. This new store of available plant food would have been derived from the store of inert, inactive, plant food, of which most soils contain a large quantity. You may exhaust a soil speedily of its readily prepared plant food; but the inert plant food is stored up safely against undue wastage, and only becomes available for use, either by the land being left for some years to the influences of the air, which gradually unlocks and sets free a sufficiency of plant food for the requirements of a further succession of crops. It is the special object of all tillage operations to open up these stores of plant food; the more deeply and thoroughly the soil being tilled, the greater the quantity of the plant food set free for the use of the crops to follow. It is very true that the more deeply and thoroughly you till your soil, the better you are able to take out of the soil, by means of your crops, the plant food the soil supplies; but in good farming the larger are the crops you produce, the greater must be your applications of manure. Remembering that you apply to the soil refuse matters which possess but a low money value, and which for sanitary reasons should be buried in the soil, and you gather, in your crops, produce which possesses a high money value. There are some soils so rich that they will grow good crops for a long series of years without having any aid from manure; but even with such soils, it is very unwise to crop them without manuring them; for, deterioration must take place when you are constantly taking from the soil and add nothing to it. Remember that so far I have been speaking chiefly of deep *tillage*, not deep ploughing. In deep ploughing you bring up to the surface of the land a portion of the undersoil; and if this has not previously been stirred by tillage implements, it may not immediately be fitted for the use of plants, or it may contain matters which are noxious to plants. In either case the surface soil will, for a time, suffer injury. Again, if the sub-soil is poorer than the surface soil, and by deep ploughing you bring the sub-soil to the surface, you must by the admixture reduce the fertility of the surface soil. It is, however, but seldom that the sub-soil is poorer than the surface soil. In most cases the sub-soil is much richer than the soil, from the latter having been deteriorated under the effects of continuous cropping without the use of manure; while, owing to shallow tillage which prevails almost universally throughout Southern India, the sub-soil is generally almost virgin soil; requiring only to be deeply tilled to be made available at once for the growth of crops. When a soil has been injured by injudicious deep ploughing, in most cases the injurious effects last only for a year or two, as the soil under the influence of the atmosphere and the sun rapidly recovers from such injury, and the raw unprepared food thus prematurely brought to the top is cooked, as it were, and rendered fit for consumption by plants. The ence between deep tillage, or cultivation, and deep pl consists in the former, in the soil being left in the same and merely stirred and moved; whereas, in deep ploughing, as I have before noticed, the fresh underneath soil is brought to the top. You may deeply till any soil without injury; indeed, with every advantage; but you can only deep plough with advantage under certain conditions; unless the deep ploughing is attained gradually, that is, say, one inch greater depth each year. There are soils that may be deeply ploughed at once with every advantage resulting. Much of your cotton soil may be deeply ploughed at once, because the sub-soils have been opened up, and have been aërated, through the agency of the long tap roots of your cotton plants. These, by penetrating the sub-soil deeply, have opened it up, and given access to air and water. Deep tillage, and deep ploughing, are beneficial, not only because these operations give the roots of your crops access to a much larger volume of soil, in which to feed, but the roots, by going deeper in the soil, are protected from the scorching influences of a hot sun; the plants growing on such a soil are during a draught much more luxuriant and robust than those growing on shallow-tilled or shallow-ploughed land. Besides, the plants on the deeply worked soil, having access to greater stores of plant food, are far more healthy, and better able to withstand the effects of disease. On well-worked deep soils, a larger porportion of the rain sinks into the soil than on shallow soils, and the deeply stirred soils becomes a reservoir for the storage of water. Again, in deeply worked soils, the watery vapour which, in the form of dews, and fogs, frequently rests over the land, finds access in the soil, and is stored there. An acre of well stirred soil will always in the dry seasons contain many tons more of water than shallow badly tilled soils, and this, of course, in your climate, is a matter of considerable importance. Shallow tillage is to be condemned from every point of view in a climate such as this. It is perhaps fortunate for you, and those who are to come after, that shallow tillage has hitherto been the rule here, for it has preserved to you a large quantity of plant food in the subsoil, which, under other circumstances, might have been used up. From what I have said, you will understand that the soil is not an inert mass, but is subjected to great physical and chemical changes, the greater and more efficacious these are the better you till your soil. But I must now pass on to notice the second subject of my lecture—ploughs.

As I have already noticed, the so-called country plough is no plough at all, but a mere cultivator. But, for convenience and simplicity, I shall refer to it as the country plough. It is not confined to India, for a plough very similar is yet met with in several other countries; indeed, judging from the evidence afforded by Egyptian monumental tablets, and similar evidence in other countries it would appear that the so-called country plough was the plough used in every country at one period of its history, but, whereas other countries have abandoned the primitive plough, and adopted improved forms, you have, in this country, made no progress in this direction. The so-called European plough is, comparatively speaking, but a recent invention. In its low cost, at first sight, the so-called country plough seems to possess a considerable advantage over the various forms of improved ploughs. But let us consider whether this is so. You know that the country plough cuts a V-shaped furrow, and thus there is between each furrow made by the plough a rib of unploughed land. Under favourable conditions, a country plough will form a furrow 5 inches wide at the top and 2 inches wide at the bottom, the section of the furrow thus measuring 15 square inches. Ploughing such a furrow the plough must travel 20 miles to go over 1 acre of land; but, you must remember that one-half of the land to a depth of 5 inches is yet unploughed, and that to move this remainder, the plough must cross the whole of the land again, thus the plough must travel 40 miles, to plough 1 acre of land, and the soil, it must be remembered, is not even then efficiently turned. But, even supposing that, in two operations the country plough could stir the whole of the soil to a depth of 5 inches, we have this fact that only 672 cubic yards of earth would be moved. Now, I have said that the distance to be travelled must be 40 miles, which is equivalent to three days' work of a country plough. In other words, to move an acre of soil to a depth of 5 inches in a day, would give full employment to three country ploughs, three pairs of cattle, and three drivers, and the soil would be moved at a cost of 1 rupee per 400 cubic yards. An improved mould-board plough would, under average conditions, cut a furrow 9 inches wide and 7 inches deep, in a perfectly rectangular form, the whole of the soil being cleanly cut, raised, and turned over. The section of the furrow would thus measure 63 square inches, against 15 square inches, the area of the section of the country plough furrow. A fair day's work for such an improved plough would be ¾ of an acre ploughed, and to effect this the cattle must travel eight miles, excluding turnings at the headlands, and the volume of earth lifted and turned over would be 705 cubic yards against 672 cubic yards moved by three country ploughs in a day. In other words, the improved

plough would, for one rupee, raise and turn over efficiently 821 cubic yards of earth; while, with a country plough for the same sum, you could move, and this very inefficiently, only 380 cubic yards of earth, but I need not press this point, for you in Bellary have given practical proof of your appreciation of these facts. I might occupy your attention for a long time in describing the different kinds of ploughs that are now made; but you would learn much more if you would pay a visit to Mr. Sabapathy Muda-r's establishment in this town, where to-day I saw one of the ... ploughs that I venture to believe has ever been got together in India. You must remember that the form of a plough has much to do with the force required to draw it through the ground. Many country ploughs, weighing only about 50lb, require much force to be exerted by the cattle in drawing them, than similar cattle would need to exert in drawing improved ploughs of twice the weight. If you will examine the model I now hold of a country plough, you will see how imperfect is its construction, and yet it resembles hundreds of ploughs in constant use in this district and elsewhere. You see there is a large block, with a broad flat surface in front. Now of course you know that it takes more force to draw through the ground such a block than a wedge-shaped one, when a narrow edge is in front. You never see boats with square bows; the bows of the boat are more or less pointed in view to cut the water in the passage of the boat, and your plough should cut the soil like a wedge, if you would get the work performed with the least expenditure of the labour of your cattle. A sort of weighing machine is used for determining the exact force exerted by cattle in drawing ploughs, and other implements, through the soil. By means of this implement, which is called a dynamometer, we can tell exactly how much force the plough cattle must employ in pulling through the soil different kinds of ploughs. I have made many experiments with this little instrument, and it has shown me that many country ploughs are much more oppressive on the cattle drawing them than would be some kinds of improved mould-board ploughs. I have found country ploughs that showed that the cattle exercised a force as much as 400lb; while the same cattle, in doing better work with some kinds of improved ploughs, would not need to employ more than half this force. Many improved ploughs are made of iron with iron working parts, but I prefer ploughs made entirely of iron; as those partly of wood and partly of iron in this country do not last long. As a rule, malleable iron is to be preferred for making a plough to cast iron; but you must remember that cast iron is cheaper and that you can readily get in cast iron duplicate of the parts of your ploughs liable to wear out, at a small expense. Steel is preferable, especially malleable steel, to either cast iron or malleable iron, for the working parts of a plough-steel offers less resistance in the soil; being stronger than cast iron, or malleable iron, the weight of the plough can be reduced without sacrificing strength. It has been suggested that this district offers peculiar facilities for the introduction of steam-ploughing; and there cannot be a doubt but that the land, generally, is well circumstanced for steam-ploughing; that is, you have vast plains of land composed of soils that ought to be deeply ploughed; land without the obstacles met with in other countries, in the form of fences, trees, rocks, &c. Until recently, the cost of fuel prohibited any possibility of steam-ploughing being attempted here; but the recent improvements in engines which have enabled steam to be raised by the use of refuse vegetable matters, such as indigo refuse, stalks of cotton plants, &c., has lessened greatly the fuel difficulty. The one great drawback that yet remains is the absence of good roads when you remember that a steam-ploughing engine weighs about eighteen tons, with its water and fuel, when ready for work, you will quite understand how impossible it would be at certain seasons to get such a ponderous machine moved about over your black cotton soils. As you will see from these diagrams, there are two great systems of steam-ploughing—the one called the-round-about system, in which only one engine is used; and, the other the double engine system. You will notice that in the former, by an arrangement of ropes the plough is moved backwards and forwards across the field between the engine, and a windlass placed opposite each other. In the double-engine system, as you will see, the plough is pulled across the field by one engine, and pulled back by the other. This system is considered the best, as the engines are locomotive, and need no help from cattle, in getting with their apparatus, from field to field; whereas, in the first mentioned system, a great number of cattle are necessary to move the engine and apparatus from field to field. But both these systems of steam-ploughing will, I think, have to give place to the new steam-digger—a new implement which is now being experimented with in England. The steam-digger is rapidly coming into favor; it has been found to perform work even more efficiently than the steam-plough, and at the rate of as much as one acre per hour. This new apparatus needs no complicated rope system, for the digging apparatus is attached direct to the engine. The invention is yet of too recent a date to admit of one speaking with any degree of confidence as to its future. All that can, at present, be said is that the machine promises to be a success. At present however, it is offered at much too high a price—£1,000. I would advise great caution in introducing steam machinery; with the rapid progress we have seen of late, in adapting electricity as a motive power, we may reasonably hope ere long to have this new motive power competing closely with steam even in the tillage of the soil.

On Mr. Robertson resuming his seat, Mr. Sabapathy Iyer, barrister-at-law, rose and addressed the meeting in Canarese, repeating the substance of the lecture in that language, for the benefit of the ryots in attendance who were not acquainted with English. He was listened to with great attention by a highly appreciative audience who, by their expressions, appeared fully to understand the special points of interest to which Mr. Sabapathy Iyer called their attention.—*Madras Mail.*

INDIAN TEA.

It is remarkable that whilst Tea is so universally used in England the public should know so little about it, and be, therefore, such indifferent judges as to what they should look for as the signs of a good article. There is a mistaken notion still abroad that "flowery Pekoe" is made of the white, camellia-like blossom from the bush, and that several species are cultivated to produce the various qualities of Teas. Many of your readers may feel an interest in learning something concerning the Kangra Valley Tea district and the method of cultivation, picking, and making of the Tea there grown. The exhausted leaves from their teapots will then guide them in their future purchases; when they have learned that in carefully made and honestly packed Tea there are no sticks or other incongruous matter, but simply the leaf of the curled, dried Tea, which has opened and expanded in the water to something like its pristine state.

All the kinds of Tea, which are described as Pekoe, Orange Pekoe, Pekoe Souchong, &c., are picked at the same moment, from the same stem, from the same bush. The barely developed little leaf, covered with a delicate down, which is just unfolding on the top of the spray, is to produce the finest Tea; the first perfect, but still tender leaves, the next; and the broader ones, lower down, the Bohea, or coarse Tea. These leaves are all manufactured together into Tea, as we shall see presently; and the best Tea to drink is, perhaps, the liquor derived from the mass as it stands. But the different sized leaves are all laboriously sorted by hand, after manufacture, before they are exported to the English market, to meet the requirements of the trade and in accordance with the China mode. These carefully sorted leaves have to be mixed again to make a Tea for actual use, such, for example, as Pekoe Souchong, which is, perhaps, the best mixture; and some of the finest Tea goes to make coarse China Teas drinkable and fit for the market. The coarse Teas from the Kangra Valley are sold in India and are not exported to England, where we get the mass of our Tea concentrated, as it were, by this removal of all leaves of scanty strength and flavour.

The Kangra Tea Plantations.

These lie along the slopes of the North-West Himalayas, nestling at the feet of grand mountains of from 10,000 to 16,000 feet high, and comprising, between the Ravee and the Sutlej, 8,000 square miles of country. The district of Kangra proper, leaving out the sub-division of Kulu, and the highly picturesque native states of Mundi, Sooket, and Chumba, extends from the Beas, where the natural watershed divides it from the Hooshiarpore district, to the boundary of the Mundi State, near Byjnath, on the one side, and to Noorpore on the other. It is in this lovely valley that most of the European Tea-planters have settled, and made around them comfortable homes and homesteads, which remind the sun-scorched visitor from the plains of India of far-off English farms.

At the upper part of the valley, and lying opposite to a huge gorge in the mountains, from which the planters obtain their daily supply of ice in the summer, lies Palumpore, the head-quarter station of the Tea district, with its Government offices, rest-house, dispensary, planters' club, and beautiful little church. Palumpore, which is 4,000 feet above the sea-level, enjoys an excellent climate for eight or nine months in the year; during the other months the heat and rains are somewhat disagreeable, although admirably adapted to the growth of Tea. The beautiful little station is situated on a series of gently sloping knolls of green turf, thickly studded with Cheel trees (Pinus longifolia), and has the universal Kangra background of mighty mountains. The place is greatly indebted to the exertions of Sir Douglas Forsyth, who did a great deal for it and its immediate neighbourhood whilst he was the Commissioner of the district. His attempt to establish an annual fair at Palumpore, to induce traders from Yarkand and other distant provinces of Central Asia to open up trade with British India, is a matter of history; and the causes of its failure are written in the records of the diplomatic offices of England and Russia.

When land has been selected and purchased (no easy task in a district where by a mistake in the settlement a great portion of the waste, or uncultivated lands suitable to Tea were given to the natives, and where the bargains have for the most part to be made with the wily intriguing Hindoo), and whilst it is being cleared of jungle and prepared for a Tea garden, the seed for the future plantations must be sown. The original seed which was used in the district was introduced by Dr. Jameson, the official Government pioneer of Tea cultivation, who selected Hotta, Bawarnah, and Negreta as gardens, and sowed that seed which he had brought from the Dehrah Doon, and which became so reproductive in the soil of the Kangra Valley that it now supplies the planters of its native Doon, and many of the younger Tea districts. H. H. the Maharaja of Cashmere has of late been a large purchaser of seed, for, not content with energetically pushing on the growth of vines and hops, his Highness seems bent at the same time on producing something with which his people may cheer themselves and escape inebriation.

The seed is carefully removed from all Tea bushes in the garden during October and November by boys, girls, and women. A large yield of seed is an indication of something wrong in cultivation, or season, or soil. The planter's object is to grow as much new, vigorous leaf as possible, and cultivation suited to leaf production is not productive of an abundance of seed or fruit; and, therefore, all that advertising dealers and brokers tell the public about flower and seed is simple nonsense to those who understand the business, and have ever seen Tea grown and made.

The ripe seed, which is picked in the autumn, has not shed its outer husk, and is sown entire as it comes from the bush in neatly made nursery drills a foot apart and 4 inches deep, a shaded spot being selected for the seed bed that it may be protected from the

cold of winter and the parching heat of the full summer's sun. As the necessary decay of the seed takes place in germination, the outer husk decays and feeds the young plant. Although this care is necessary in raising seedlings in the comparatively temperate climate of Kangra, the hot steaming climate of Assam, where Tea is indigenous, produces all vegetation in such luxuriance that the seed has but to be dibbled into the land which it is permanently to occupy like a row of beans.

CULTIVATION.

The periodical rains commence in the Kangra district on or about June 15, and, if they be not too heavy, the seedlings may be transplanted to their places in the garden at the beginning of July. For this planting out, arrangements will have been made during the winter months. In rich soils, where the growth of the bushes will be quick and luxuriant, the seedlings are put in at greater distance from each other than in poorer soils, where the bushes will be longer in approaching each other. According to soil, these pits, 2½ feet deep by 1½ foot wide, are dug in rows varying from 5 feet by 5 feet in good soil, to 3 feet by 4 feet in poor soil, and into each of these pits from ten to twelve seedlings are planted. The coolies who put them in are drilled by a jemadar, or headman; who takes his place and orders from the planter himself; and so well is the work done in this way that the plants are rarely an inch out of the direct line, or of the proper depth in the soil. Under the magic wand of English energy, what was but now virgin soil of the forest or the village common, or the arable land of the natives, is a young Tea plantation, not yet ready to be plucked, but growing wondrously fast, needing to be carefully terraced to keep the soil up, if it be on a slope, and to be sometimes irrigated in hot, dry weather. In three years the plants in good soil begin to be profitable, and need no further waterings, although they are not in full bearing for, perhaps, seven or eight years.

During their minority each plant requires careful cultivation, constant hoeing, fairly liberal manuring, and judicious pruning. In November the winter cultivation of the mature bushes begins. Divisions of men—the strongest and possibly the least intelligent—are told off to hoe the garden throughout 1 foot deep; and this hoeing work should go on all the year round with variations at different seasons of the depth of hoeing.

PRUNING.

Simultaneously with the hoeing, so that all that is cut off the bushes may go back and be buried in the soil, the pruning commences. As pruning is one of the most important works on a plantation, so is it one on which there is the greatest difference of opinion. A great many experiments have been made in the art, and probably planters have not yet learned all the science of the subject. Ten years ago an indiscriminate slashing off of the top of the bush and cutting three or four large holes into the body of the plant, to let in light and air, was the style of pruning most in vogue, chiefly on account of its fancied economy. By this method of pruning numberless shoots no doubt sprung up in the spring, but from the very fact of their being so numerous the bush was choked up as to all after-growth, and became a mass of unproductive crows'-feet.

Thorn pruning was next tried, and it may answer admirably in a cold climate, but certainly it is not the proper method for shrubs in high temperature, such as Tea requires, for they need protection from the sun and from electric and winter hail, without which the wood branches and the sap dries.

Coppicing, as a last remedy for old woody plants, was then tried; but the remedy is a most severe one; the plant loses much strength by the inevitable bleeding which takes place, and consequently the new shoots it makes are weak and feeble.

A new method of pruning which has been introduced into the valley is at present the approved one. The old, white, gnarled wood, and all the "whip-cord," is cut off entirely an inch or two below the surface of the soil in such a way as shall cause the bush to bleed as little as possible. Then all the long, straggling shoots are cut back, no matter how good their material may be; and lastly, all the shoots are cut back close to the finest bud growing from the axilla of the leaf, which is left to act as shelter.

Bushes of about 4 feet in height are the most convenient for boys and girls to pick from, and some of the finest bushes in the Kangra Valley gardens are of this height, and 6 or 7 feet in diameter.

Pruning operations are going on from November to the end of the first week in March. Boys in India are almost always sharper and more active and willing than men. Strong, picked men cut out the thick, tough wood from beneath the soil, and the lighter pruning is done by the boys. The best pruner cannot average more than twenty full-grown bushes in a day.

(To be continued.)

A POULTRY FARM.

THE following account of a poultry farm forms a part of the report on Huntingdonshire, which, as an Assistant Commissioner, was written by Mr. Druce for the Royal Commission on Agriculture. The paper, with a note appended, appeared in the *Journal* of the Royal Agricultural Society of England.

The farmers in Huntingdonshire have endeavoured to meet the bad times as well as they could; and among other attempts that have been made, one of them has tried poultry farming on a somewhat large scale. The farmer who has tried this lives at Kimbolton, and up to a year or so ago he farmed a good-sized farm of between 500 and 600 acres; but finding things were going badly, he gave up the larger farm and retained one of about 100 acres only, and it is upon this that he is trying poultry farming. The soil of the farm is a tolerable stiff clay, and most of it is already, or will very soon be, drained. It is farmed pretty much on the four-course system, and the poultry is the chief live-stock kept upon it.

The farmer had kept poultry in some numbers for the past five or six years, whilst he held his larger occupation; but he had not kept a separate and distinct account relating to them till the year 1880, and since he had given up that occupation. He stated that he was trying the system because of the very large importations of poultry and eggs into this country, and because he thought that poultry, if properly attended to and treated in a business-like way, would pay. He kept fowls only, not ducks, geese, or turkeys. He had tried various breeds of fowls, but preferred the light Brahmas to all others, because from experience he had found that breed to be the hardiest and most prolific. His stock at the time of my visit (October 1881) consisted of about 1,800 head, which in the winter would be reduced by some 300 or 400, so that at that period of the year he would have about 1,400 or 1,500. He keeps no old stock, but sells all his birds before or when they are two years old. He is careful to have fresh blood in his stock every year, and for that purpose periodically introduces three or four male birds of some other strain than his own of the light Brahma breed. His stock has always been healthy, and absolutely free from any epidemic during the six years that he has kept it, and though he has occasionally lost a few birds, his losses from disease have been very trifling. He keeps the poultry partly in yards at the farm homestead and partly in the fields. There are nine yards at the homestead of different sizes for convenience sake, and separated from each other by wire netting; and attached to or near them are houses for the fowls, such houses being parts of the farm buildings adapted for that purpose. The fowls in the fields are divided into different lots, each lot containing about 150 birds, and having a separate fowl-house: these houses are about 16 feet long by 8 feet wide, and 6 feet high up to the eaves of the roof, and contain from 750 to 800 cubic feet each, or rather more than 5 cubic feet to a bird. They are built of wood, and are moved from one part of a field to another very easily by one horse. The field houses, when I saw them, were on a piece of land that had been laid down to grass about two or three years ago; and just previously they had been on some young seeds sown in a barley crop which had not long been harvested. As soon as the ground near the house has become much trodden, the house is removed to some other spot. These removals take place about every fortnight. The yards at the homesteads are changed once a year, and the ground which has been used as a yard is left for a year without any fowls being put upon it, in order that it may become sweet, and freed from the taint of the birds. All the houses are scrupulously clean, and are constantly lime-washed. The birds, except the young chickens, are fed three times a day; in the morning with salt food, consisting of boiled potatoes, mangels, carrots, or parsnips, mixed with barley flour, which mixture is given warm in the winter; in the middle of the day they are fed with inferior corn; and at night with a full feed of sound maize—the best description of that corn only being used, and it is given to the fowls whole, and not split. No particular quantity of food is given at either meal, but notice is taken whether any of that which is given is not picked up, and if such is the case, less is given. Occasionally the fowls have green food, and in the winter meat. The meat is boiled horseflesh or beef, and care is taken that the meat is that of a sound animal, and of an animal that has been killed, and not of one that has died of natural death. The chickens are fed as often as six times a day, with all sorts of food, and are most carefully looked after by the man in charge and his boy, who are the only labourers employed for the poultry. The manure made by the fowls is used on the farm as a top-dressing for corn, and is mixed with malt dust or kiln dust, which is spread over the floors of the houses, and absorbs the manure when it is dropped. In this way the houses are more effectively cleaned out, and the manure so mixed is found to be very efficacious. The poultry and eggs are for the most part sold for consumption in London, but occasionally a few of each are sold locally. The following is a statement of the receipts from, and expenditure upon, the poultry for the year 1880:—

RECEIPTS.	£.	s.	d.
For eggs and poultry sold in London	433	10	10
,, ,, to house	16	1	0
,, ,, to Dowden	2	10	0
,, ,, to others	9	10	0
For manure	27	0	0
,, feathers	3	0	0
	£491	11	10

EXPENDITURE.	£.	s.	d.
Paid for food	330	0	0
,, labour	55	0	0
,, eggs	10	0	0
,, rent	38	0	0
Depreciation and renewal	18	10	0
Interest	15	0	0
Balance (profit)...	25	1	10
	£491	11	10

The capital employed in the poultry farm was taken at £300, and was considered as being the same at the beginning and at the end of the year, and interest at 5 per cent on that amount is allowed in the foregoing account; there was, however, in fact, rather a larger head of poultry at the end than at the beginning of the year, the actual numbers being on January 1, 1880—1,433; on January 1, 1881—1,492; but the difference

in number was not sufficient to make any material difference in the value. Of the £300 capital, £200 was taken as the value of the poultry, and £100 as the value of the fowl-houses and other dead-stock; but the former sum seemed to be very inadequate, and, upon consideration, the farmer added this note to the above account:—"I have charged 5 per cent interest on £300—viz., £200 for fowls and £100 for houses—though I consider my fowls, being birds of noted strains, are worth £400.' If, then, we take the whole capital in the concern at £400 (the mean between the capital of £300, on which interest is calculated in the above account, and £500, the amount at which, upon further consideration, the farmer estimated it), which would, as far as I could make out, fairly represent actual capital invested in the concern, we find that a return of some £40, or 10 per cent was made, the £40 being divided in the account into £15 for interest and £25 for profit; but if we take the capital at £400, and allow interest at 5 per cent on that sum, we have only £20, or 5 per cent left for profit.

This farm seems to be a fair example of what can be done by poultry farming, for there are no special or adventitious circumstances as regards soil, position, or otherwise connected with it, but the farmer thoroughly understands the business; he is learned in poultry, and devotes much of his time to them. He is not only fond of poultry, but of other animals, as is shown by the fact that he keeps a large number of bees on the most approved modern and scientific principles, from which he endeavours to make a profit. I cannot, however, state whether his bee-keeping has been profitable, for he has only kept them in large numbers during the past year, and has not kept separate accounts for them. I need hardly add that this poultry and bee farmer does not depend upon his poultry and bees, and his small farm alone for a livelihood. In reply to my question whether he thought that poultry farming on a very large scale would pay, he said he thought not; but that the best and most paying way to keep poultry was for the cottagers to keep a few each for their farmers, the cottagers' wives being paid so much per head for every chicken reared.

Before sending the foregoing description to the Society, for publication in its *Journal*, I wrote to the farmer whose poultry farm I have described, to ask him for a copy of his balance sheet for the year 1881, in order that the description might be brought down to as late a date as possible. In reply to my letter the farmer wrote as follows:—

"I have been trying to get out a balance sheet of my poultry farm for the year 1881, but find I cannot get at all the details, owing to their being mixed with the other business transactions; but I am satisfied, were I able to do so, they would not be found more satisfactory than those I gave you, in a financial point of view; in fact, my impression is such that I intend much reducing my stock and breeding for fancy sale only, feeling assured that breeding for the market cannot be made to pay on a large scale. I much regret being unable to comply with your request."

This letter would appear to show that the longer experiment had convinced the farmer of the correctness of the opinion he expressed to me,—namely, that poultry farming on a very large scale would not pay.

THE LIQUID-AMBAR, OR SWEET GUM.

There seems to have been great diversity of opinion amongst the older botanists as to the natural affinities of this genus. Some included it in a large and incongruous order, including all those trees with catkins as oaks, beeches, willows, and planes. Some made it an order by itself, called Balsamaceæ; more recent authorities, however, class it with the witch hazels of North America. The catkins of the female flowers are globose, and resemble those of the Plane externally. The trees themselves that are hardy in this country are much like Maples. Apparently only three species are known, inhabiting the warmer parts of North America, Asia Minor, and the South of Asia, especially Java.

Liquid-ambar styraciflua is the best known species in this country and the most ornamental. It inhabits the United States, extending southwards into Mexico, where it attains its maximum dimensions in swampy or wet places near rivers. Thirty or forty feet is the average height of the tree in this country, but if planted in a sheltered, moist place, it attains the height of 60 or 80 feet. It grows slowly, and with a little attention can be kept in pyramidal shape, forming at once a highly ornamental and interesting tree for the lawn or pleasure-ground; or if planted near the margin of large clumps, or on islets on ornamental water, it could not fail to be productive of the most pleasing effects. The leaves are acutely five-lobed, and serrated with woolly tufts at the conjunction of the veins beneath. They have a dark green leathery appearance, and when ripening in autumn become a blaze of deep purplish-red and orange. The bark is corky and fissured, but at a little distance is hidden by the dense leafage. Beneath the bark all parts of the tree are pervaded by a resin of a sweet balsamic fragrance. This substance is most highly developed in warm countries, and exudes spontaneously from any wound in the bark. It is of a clear or amber transparent colour, whence the generic name of the tree from "liquidum," fluid, and "ambar," amber.

The best is obtained by purposely making incisions in the bark, and a second-rate quality by boiling the bark and branches, when the oily material floats on the surface and is skimmed off. Another mode of obtaining it is by putting the inner bark in a bag and submitting it to pressure. This substance is used medicinally in several countries, and to a small extent in this. It is supposed to possess healing and balsamic properties, and in some degree to be stimulating and expectorant, while an oil extracted from the same substance is used in perfumery. The heartwood of the tree is dark, with a beautiful compact grain, and furniture made of it has a handsome appearance. The product of this, as well as the following tree, has superseded the storax of the ancients, which was obtained from Styrax officinale, a low tree inhabiting South Europe.

L. imberbe, otherwise known as L. orientale, a low tree inhabiting Asia Minor, seldom exceeds 6 feet in height in England. It bears considerable resemblance to Acer Campestre, the common small-leaved Maple. The leaves are much smaller than those of L. styraciflua, with shorter, blunter lobes, and glabrous beneath; hence the specific name "imberbe," beardless. As an ornamental tree it is much inferior to the North American one, but interesting on account of its relationship. Although presenting the appearance only of a bush in tree form it is worthy of a place amongst other deciduous subjects, or as an isolated specimen on grass where a large tree would be inadmissible. Its economic uses are the same as that of the former tree.

L. altingia is a noble tree, inhabiting the forests of the West of Java, where it attains the height of 200 feet, and is found at elevations of 2,000 or 3,000 feet. The wood is reddish, and afterwards brown, of a beautiful compact grain, and, like its congeners, redolent of a grateful balsamic odour. The leaves are ovate-oblong, acuminate and serrate, quite a different type from the other species. As might be expected, it is not hardy in this country.

L chinensis, sometimes seen planted against a wall in the open air, appears to be synonymous with this species. In severe winters it gets killed to the ground.

The hardy species are propagated by layers, or imported seeds—preferably the latter, because trees produced from layers seldom or never make such handsome specimens as those from seed. —*Observer*.

THE PROSPECTS OF INDIAN TEA.

These are bad times for people who are personally interested in the well-being of tea estates in India, and there is no prospect at present of a change for the better. Cultivators cannot reasonably count upon an uninterrupted succession either of good crops, or of good prices; they must have their "downs" as well as their "ups"; they must have their bad as well as their good years. But the drop in prices of 25 per cent and upwards, that is shown by a comparison of present quotations with those ruling in London a year ago, is a disaster that the shrewdest planter may be excused for not foreseeing. Such a drop may mean something near to ruin to planters with small capitals or with many debts. By such as these money was wanted to open out ground, and the money was obtained from bankers at rates of interest regulated by the knowledge of the riskiness of the venture. The prices now realised for crop will probably not leave a surplus to meet the periodical payment of interest. Retrenchment in expenditure on the preparation of teas will be forced on the planters whose financial position is precarious, and such retrenchment means a lowering of quality. Already is the complaint made in London that the Indian teas are not as good as they used to be. In a falling and depressed market dealers are inclined to be hypercritical, or to discover, and make much of defects that they say nothing about when the market is firm. The London market is glutted with Indian tea, and is consequently in an irritable, bilious mood. "The supply of low-class Indian tea," says one London circular, "has largely increased of late, recent invoices containing a heavy proportion of Pekoe Souchong and Broken tea, with a general falling off in quality compared with earlier shipments, especially in Assam teas." It is also said that "last season owing to the general excellence of the crop the low grades had very superior liquors, while this season, although attractive in leaf, they are somewhat deficient in strength and flavour, the natural result perhaps of larger crops, and consequent lower standard of quality." We doubt, however, whether the planters have been so blind to their own interest as to be seriously inattentive to quality, while they have striven to increase quantity; and we doubt also whether the leaf of 1882 is markedly different from the leaf of 1881. While the latter went to a good, the former has gone to a bad, market, and does not perhaps have full justice done to it.

The London market cannot easily absorb the quantity of tea that now reaches it from India and China. In 1871 the exports of tea from India to all ports were 13½ millions of pounds, valued at £1,139,703; in 1881 they were 38·2/5th millions of pounds, valued at £3,072,244. The consumption of Indian tea has increased necessarily in the ten years; but during that time China has largely increased her export, and it is commonly said in London that the supply of tea of one sort or another is in excess of the world's demand. From January to November, both inclusive, in 1880 the imports of Indian tea in London were 38 millions of pounds; in the same months of 1882 they were 48·2/5th millions of pounds. The imports of China tea were 138½ millions of pounds in 1880, and in 1882 they amounted to 148⅕ millions of pounds. So the total imports of Indian and China tea were 196·3/5th millions of pounds in the first eleven months of 1882, as compared with 177½ millions of pounds during the corresponding months of 1880. Taking the twelve months, January to December, and we find that the imports of tea from all ports into the United Kingdom amounted to 128 millions of pounds in 1867; to 141 millions of pounds in 1871; to 185 millions of pounds in 1876; and to close upon 210 millions of pounds in 1871, thus showing the enormous increase of 82 millions of pounds in fifteen years. The quantity retained for Home consumption in the United Kingdom was 111 millions of pounds in 1867, and 160 millions of pounds in 1881, showing an increase of nearly 50 per cent. in the fifteen years, during which the population increased from 35½ to 39·2/5th millions, or by about 16⅔ per cent. The stock of tea in London on the 1st December 1882 was 22 millions of pounds heavier than on the

same date in 1880. The pressure of this undesired addition to a stock that was supposed to be ample in 1880 has naturally sent down prices, and to some extent stimulated consumption ; but not to the extent naturally desired by planters and shippers. The British public is still but little acquainted with Indian tea. There are a few shops in London which make a boast of selling their own "blends" of Indian and China tea, and at two or three places none but Indian tea is sold. But, generally speaking, the fact that more than a fourth of the tea consumed in England was grown in India is not known. The China teas have fallen off so much in quality of late years, or such large quantities of comparatively speaking "rubbish" have been shipped from China, that the chief use to which Indian teas are put is that of supplying the deficiencies of the China produce. A low quality and large quantity of China tea mixed with a high quality and small quantity of Indian tea results in a merchantable article, that is consumed by persons who do not dream that India has given the flavour that they find palatable in "the cup that cheers but not inebriates" them.

In the following table showing the prices current in London on the 7th December of Indian teas (for which we are indebted to Messrs. W., J., and H. Thompson's circular,) it will be observed that high prices in 1879 were followed by very low prices in 1880, and that high prices in 1881 were succeeded by low prices in 1882. Possibly, then, it will be the turn of 1883 to see prices that will gratify the planter, and recoup him for the disappointment he is now enduring :—

		1882.	1881.	1880.	1879.
		s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
DUST ...	Pale brown to black ...	0 5 to 0 8	0 8 to 0 10	0 7½ to 0 9½	0 11 to 0 2
FANNINGS ...	Pale chaffy to brownish ...	0 6½ to 0 7½	0 9 to 0 10	0 7½ to 0 8	0 11½ to 1 1
	Darkish, leafy ...	0 8 to 0 8½	0 10 to 1 0	0 8½ to 0 8½	1 1 to 1 2
BROKEN TEA ...	Darkish mixed broken Souchong leaf	0 8½ to 0 9½	1 0½ to 1 2½	0 9 to 0 9½	1 1½ to 1 4
	Black and more even leaf, strong and fine ...	0 10 to 1 2	1 3 to 1 6	0 10 to 1 0	1 5 to 1 8
BROKEN PEKOE ...	Small blackish leaf with tips ...	0 11 to 1 2	1 4 to 1 8	0 10½ to 1 3	1 4 to 1 6
	Even leaf, with tips, strong and full ...	1 4 to 1 10	1 9 to 2 0	1 6 to 2 0	1 8 to 2 2
CONGOU ...	Roundish twisted leaf ...	0 8½ to 0 9	1 0 to 0 0	0 9 to 0 9½	1 0½ to 1 1
	Even leaf, with quality ...	0 9 to 0 9½	1 0½ to 1 1½	0 9½ to 0 10	1 1 to 1 2
SOUCHONG ...	Coarse open leaf to good medium ...	0 8½ to 0 9½	1 1½ to 1 2½	0 9½ to 0 10	1 2 to 1 3
	Well made leaf, strong and full ...	0 10 to 0 11	1 3 to 1 4	0 10½ to 0 11½	1 3 to 1 5
	Even well made leaf, but weak... ...	0 9 to 0 10	1 2 to 1 3	0 10 to 0 11	1 3 to 1 4
PEKOE SOUCHONG ...	Well twisted leaf, good strength and flavour ...	0 11 to 1 3	1 4 to 1 5	0 11½ to 1 2	1 5 to 1 8
	Common coarse leaf, and low quality ...	0 11 to 0 11½	1 3½ to 1 4½	0 10½ to 0 11½	1 4 to 1 5
PEKOE ...	Well made leaf, with tips, fair quality ...	1 0½ to 1 3	1 5½ to 1 6½	1 0½ to 1 5	1 6 to 1 8
	Even wiry leaf, full and strong ...	1 4 to 1 10	1 7 to 1 10	1 7 to 2 0	1 9 to 2 0

Though we decline to endorse the implied imputations of London dealers on tea-planters in India, we do not forget, nor should the planters themselves forget, that two years ago the Government of Sir Ashley Eden went out of their way to inculcate in a paternal manner upon the planters of Assam the extreme importance of conserving, by conscientious manipulation after careful cultivation, the high prestige of India tea. There are at the present time 171,193 acres under tea in Bengal, 10,174 acres in the Punjab, 170 in Burmah, and 40,000 acres in Madras, or 185,537 acres in all British India. Given good prices and a steady market, and India, with a cultivated area of 136 millions of acres, may easily spare at least 400,000 acres, or an area equivalent to that occupied by tobacco, for the production of tea. The export of tea from China increases every year ; but the proportion of really good to unquestionably inferior tea that she ships is steadily declining. Were the mandarins wise they would exercise a pressure, gentle or otherwise, upon their countrymen in tea districts, in order to bring home to them the fact that "lie" tea must in the long run be ruinous to those who to make it, and that apart from all moral considerations "honesty is the best policy." India is strong in high-class teas, and her planters should spare no pains to maintain the repute of those teas in European, American, and Colonial markets.

DIVI-DIVI.

THE cultivation of casuarinas has been of great pecuniary benefit to many persons in Madras, but it is only for timber that they are grown. Our attention has recently been called to the fact that there is a very good opening in this Presidency for the cultivation of the Divi-Divi tree, known in America as the Sumach, and botanically as the *Cæsalpinia coriaria*, which produces not only timber, but what is more valuable, seed-pods, which realise a high price. It may be grown, too, as an ornamental tree. Some correspondence has appeared in our columns during the past few days, from which it appears that, though known to a few agriculturists in the Presidency, the advantages of growing it are not generally known, nor does it appear to have been cultivated to any great extent. It was introduced into India about the year 1830, and has been thoroughly acclimatised in South India, which, in soil and climate, resembles its original home. The largest plantation of Divi-Divi we have seen is that on the premises of Mr. J. B. Cardozo at Perambore, and before dealing with the subject generally, we will relate Mr. Cardozo's experience. Some twenty-five years ago two trees were planted in front of Mr. Cardozo's house, and flourished. A few years ago the value of the seed-pods for making ink was discovered, and Mr. Cardozo made enquiries which resulted in his sending seven bags of seed-pods to the London market in 1878, as a sample parcel. The brokers wrote with regard to it that "it is good and bold, and this quality will always command a ready sale at 13*s*. to 14*s*. per cwt. in large quantities, as far as can be judged at present." The parcel realised 13*s*. 9*d*. per cwt., and after paying all expenses, Mr. Cardozo realised a clear profit of about Rs. 9 per tree. Finding that the seed-pods were useful for dyeing and tanning, as well as making ink, Mr. Cardozo planted out a large number of trees, and he has now a plantation of about 600 trees. The manufacture of ink from Mr. Cardozo's seed-pods was extended, and a native of Madras has succeeded in obtaining a contract to supply the Government of India with ink powder for all the local Governments, the principal ingredient being obtained from Mr. Cardozo's seed-pods. The trees we specially refer to grow in what appears to be a clay loam of alluvial origin. The Divi-Divi generally grows well in a sandy loam. A sample of Divi-Divi pods grown on such a soil was recently analysed in Madras, and contained, in the marketable form, 27 per cent of tannin. Dr. Balfour states that the experiments made by Mr. Rootsey, of Bristol, showed the pods to contain 50 per cent of tannin, and that it is largely used by curriers. He also mentions that "the seed-pods on this tree being known to contain a large percentage of astringent matter, induced Dr. Cornish to use them in fever." The tree grows where the babool will, but does not like standing water. Mr. Cardozo believes that some of his trees which are shaded have grown better than those which have been exposed to the sun, but we do not think the tree really needs shade. In a Government circular published some time ago, we notice that it is recommended that the tree should be put down six feet apart, so that an acre of land will contain 1,210 trees, but this is surely a mistake, as the older trees at Perambore are 22 feet apart, and are already interlaced to the extent of six or seven feet. This would be prevented, of course, by pruning. The tree soon bears seed-pods, those at four years old bearing a large number : some branches producing so many indeed as to be unable to support them in a breeze. We should be inclined to plant it in lines in the same way as the Corkapillay—*Inga dulcis*—is planted for forming hedges, but at wider intervals ; to be pruned but not clipped. Irrigation is necessary as long as the trees are not sufficiently grown up to dispense with it. The pods, and seeds contained, are usually sold together, and not the seed alone, as some writers seem to imagine. There has hitherto been very little trade in Divi-Divi pods in Madras, the exports during the past lustrum being as follows :—

1877-78	... 165 cwt.	valued at	... Rs. 660
1878-79	... 15 ,,	,, ,,	... ,, 73
1879-80	... 169 ,,	,, ,,	... ,, 580
1880-81	... 150 ,,	,, ,,	... ,, 633
1881-82	... 133 ,,	,, ,,	... ,, 821

We have noticed a few trees in some of the public places in Madras, such as the Napier Park, but doubt whether the produce has been gathered and sold. The Government have the subject under consideration, and we may soon hear of steps being taken to encourage the growth of the tree in this Presidency. We should certainly recommend a thorough enquiry into the matter, as the cultivation of Divi-Divi involves but little expense and trouble, and many an acre of land now producing nothing, or but very little, could probably be converted into a flourishing plantation. At any rate, the experiment is well worthy of a trial. The trees which have been planted on the site of an old manure heap at Perambore appear to have grown much better than the rest, and those who can afford to apply manure will probably find it profitable to do so. Divi-Divi is attracting attention in other countries we see. In the report on the Public and Botanical Gardens, Jamaica,

for 1881, we notice mention is made of "a piece of good land of about 2 acres in extent which has been enclosed with a hedge of limes and laid out in beds for raising the most important economic plants. The number of these plants ready for distribution amount to 32,000, and among them are Liberian Coffee, Nutmeg, East Indian Mangoe, Pimento, Oranges, French Limes, Casuarina, Jaipur Cedar, Kola-nuts, Teak, *Bois immortelle*, Divi-Divi, Madras Thorn," &c. The tree is described in the *Treasury of Botany* :—

"*C. Coriaria* is a small tree twenty or thirty feet high, native of several of the West Indian islands, Mexico, Venezuela, and North Brazil. The primary divisions of its leaves vary from nine to fifteen, each bearing from sixteen to twenty-four narrow oblong blunt leaflets, marked with black dots on the under surface. It has branched racemes of white flowers, which produce curiously flattened pods, about two inches long by three-fourths broad, and curved so as to bear some resemblance to the letter S. The large percentage of tannin in these pods renders them exceedingly valuable for tanning purposes. They are known in commerce under the names of Divi-divi, Libi-divi, or Livi-dibi, and are chiefly imported from Maracaibo, Paraiba, and St. Domingo."

In Day's *Gardener's Dictionary* vol. II., p. 432, the 4th section of Cæsalpinia is given as *Libidibia*, from *Libidibi*, the name of the pod of this plant in Curaçoa, the Cæsalpinia coariria of Willdenow, which is a native of Curaçoa, Carthagena, and St. Domingo, in salt marshes by the sea-side. The legumes of this plant are called Libi-Dibi and are used in tanning leather when ripe by the Spaniards and natives. The tree grows 15 to 20 feet.

In the Bombay Flora of Danzell and Gibson published in 1861, this plant is noticed as follows :—

Cæsalpinia coriaria, Libi-Divi. Native of South America.—A spreading, umbrageous tree; not high; leaflets minute; legumes very numerous, variously contorted; has been raised extensively at Hewra and Dapoorie from seed received through the late Dr. Wallich. This tree is likely to be of great importance on account of the excellent tanning material which it affords.

The seeds of the plant were introduced into Ceylon some years ago, and the result was that several of them germinated but died immediately afterwards, probably owing to the climate being too damp. On the other hand, this is what Dr. Trimen writes to the *Tropical Agriculturist* :

"Royal Botanical Garden, Peradeniya, 3rd Aug. 1881.

"SIR,—It may perhaps be instanced as a good example of the habit of passing by what is close to us without notice, that neither you nor your morning contemporary, in your remarks on 'Divi-Divi,' have seemingly been aware that the seeds of *Cæsalpina coriaria* are regularly advertized in your columns, along with other useful plants on sale at these gardens. The fine old tree of this species near the entrance to Peradeniya affords an abundant crop of pods every year, and there can be no doubt that the plant would flourish generally at the lower elevations in Ceylon."

Dr. Cleghorn, in his "Forests and Garden of South India," says that small plantations of *C. coriaria* exist at Bangalore, Guntoor, Hunsoor, Masulipatam, &c., and that the tree grows well in most of these situations.

In November 1881, the Divi-Divi tree was thus alluded to in our columns :—

"A correspondent writes :—This plant, which grows in many of the outlying villages of Madras, and has been up to date uncared for, is now found to be a valuable article for tanning purposes. Large quantities of the pods these plants yield are being shipped to Europe, and in fact many persons have begun to pay some attention to the cultivation of this plant. A consignment of 88 bags of dried pods from this plant was shipped to England by the *Duke of Buckingham*." 173 trees of the Divi-Divi in full bearing, which would take an acre of land, is supposed to yield 50 cwt. of pods, which are valued in London at £37 10*s*. ; and as the cultivation and care cost literally nothing after the trees are once in bearing, it is found to be a most profitable crop.

And a few months afterwards a correspondent of a local paper wrote as follows :—

"The Divi-Divi pods are employed for tanning purposes, as they contain 50 per cent of pure tannin. I have been told that in Bangalore there is a large plantation of this tree, and that its pods are largely used for giving the skins that superior smoothness remarkable in the Madras and Bangalore skins. I have also used Divi-Divi in dyeing, and I have employed a solution of acetate of iron after the bath in Divi-Divi tincture. The ink used in most of the Government Offices in Fort St. George is made with this plant. The cultivation of this elegant shrub is very easy. The seeds should be sown in March, and the young plants can be removed from the nursery during the following rainy season. They require some watering till they have attained the height of three feet, after which no more care is necessary. This plant grows luxuriantly in a clayish calcareous soil, but very slowly in red soil, as I have observed at the Red Hills near Madras. I think the difference in the growth in the two soils results from the clayish soil retaining moisture for a very long time in the summer, while in the latter the young plant is exhausted by the strong dry winds blowing then. But I think it still possible to cultivate this shrub in red soil with some success by adding dry mud from tanks to the soil before replanting the young tree from the nursery. Cow-dung ashes will prove useful round the plant. The great difficulty to contend with, however, in such soil is the want of water. The cultivation I have made for the last few years is quite a success, and I have made experiments in both soils, clayey as well as red. I shall feel obliged if any of your readers will give me some information regarding the market current price of this dye in London or elsewhere. I think that the high rate of freight from India to Europe will not allow a margin of profit in the shipment of Divi-Divi husks."

Toward the middle of last year the following appeared in a Calcutta paper :—

"The Superintendent of the Government Farm, Khandeish, recently shipped a consignment of Divi-Divi to the London market. Divi-Divi is the fruit of a tree which has some resemblance to the tamarind. It is used for tanning purposes, and meets with a ready sale. The consignment consisted of 14 cwts. and realized £10 7*s*. 1*d*., or close upon £15 the ton. From this sum, however, must be deducted the charge for freight, insurance, brokerage, &c., a deduction which brought down the balance to £6 17*s*. 7*d*.; which, at the rate of exchange at the time of the transaction, was equal to Rs. 83-1-1. The expenses of production in India had amounted to Rs. 29-7 ; accordingly the superintendent cleared a balance of Rs. 53-10-1. At these rates, for every ton of Divi-Divi sold in London the exporter might count upon a profit of Rs. 80. The advantages of the cultivation of the Divi-Divi tree are that it will grow in soil which is sandy and contains little nourishment, and is thus useless for average agricultural purposes, and that consequently, as may be imagined, the tree needs little attention and care. The demand in England can be reckoned upon as a fixed element."

In Chamber's *Encyclopædia* we find the following reference :—

"Divi-Divi or Libi-Dibi, the curved pods of *Cæsalpinia coriaria*, a tree which grows on the coasts of Curaçoa, Carthagena, and other parts of tropical America. They have been long used there for tanning, but have recently acquired importance as an article of commerce. A considerable quantity is now annually brought to Britain. Divi-Divi is one of the most astringent substances known."

"A," writing from Nellore a few days ago, says :—

"Adverting to the enquiries of your correspondent PLANTER, I have the pleasure to intimate that Divi-Divi is the common name of the pod of the *Cesalpinia coriaria*, a leguminous plant found in low marshy situations in the northern parts of South America. It is used both for dyeing and tanning, but chiefly for the latter purpose. The pod is from 2 to 3 inches in length by 3¼ inch in breadth, and when in perfection, is of a rich brown colour. It contains a few small seeds, but the only valuable portion is the matter of a bright yellow colour, easily pulverised, which lies betwixt the outer skin and the husk that encloses the seed, and contains a large quantity of tannin. Divi-Divi is used not for the colouring principle but for its strong astringent quality as a mordant, and is used instead of sumach, which is scarce. In tanning it accelerates the process, and imparts to the leather a clean and healthy appearance. Mr. T. Ward at Madnapully is the owner of some trees there, and may probably be able to give more information, and also furnish seeds, if applied to."—*Madras Mail.*

THE LIME AND LIME-JUICE.

A CEYLON resident now in England, having noticed a query put by a correspondent in a recent issue regarding the lime and the profitability of its cultivation, has sent us a little pamphlet, entitled "The Island of Montserrat, West Indies, its History and Development, chiefly as regards its Lime Tree Plantations ; with a short description of Lime-Fruit Juice and its use as a Medicinal Agent and a Beverage." The pamphlet opens with a description of the island, as follows :—

"The little Island of Montserrat, considered the most healthy of the Antilles, situated in 16° 45' north latitude, and 61° west longitude, and about eight miles in length from north to south, by a breadth of five miles from east to west, is composed of a small cluster of volcanic mountain tops, rising out of the Carribean Sea to the height of of 3,000 feet, the summits being more often concealed by floating clouds. These high mountains seem to protect Montserrat from the hurricanes which desolate the neighbouring islands as the forests ensure a rainfall when those islands are suffering from still more disastrous drought. The slopes from the hills to the sea are covered with emerald cane fields, or with the darker verdure of the lime orchards."

After a short summary of the history of the Island from its discovery in 1493 down to the present century, the writer says :—

"The first lime tree orchards were planted in 1852, by Mr. Burke, an enterprizing planter then living in the island, but the speculation was at first by no means profitable, as this is an enterprize that involves a large outlay of capital, which is for a number of years unproductive, and even then only remunerative on a large scale ; although the low rate of wages and extent of uncultivated land on a salubrious climate renders the Island of Montserrat particularly suitable for the purpose.

"The lime tree (*Citrus Limetta*) is a member of the orange tribe, which grows wild in many tropical countries, but does not flourish even so far north as the Azores. It is a thorny, bushy, evergreen tree, with handsome dark-green leaves. These are so fragrant that they are universally used in the West Indies to perfume the water in the finger-glasses at dessert. The small white flowers resemble orange blossom, and the scent is equally delicious.

"*The plantations of the Montserrat Company already cover more than 600 acres, and contain 130,000 trees.* These are generally planted fifteen feet apart, and the high road passes through them for a distance of more than two miles. No more beautiful sight can be seen than these orchards, when the trees are laden with their bright fruit, and at the same time the air is pervaded by the luscious fragrance of the blossom. The fruit is gathered by the negro women, and they carry it down in baskets on their heads.

"The important antiscorbutic properties of lime-juice have been well known for many years, and the refreshing lemonade which is made by mixing it with water and sugar is universally used in countries where the tree grows. The bulk of the lime-juice that is offered in the English market (and from which most lime-juice

cordials are manufactured) is made from the fruit of the trees that now grow *wild* so abundantly in Jamaica, Tahiti, and elsewhere. In some parts of Jamaica the negroes go about the country squeezing the fruit they find under the scattered trees into a pail with a wooden kitchen lemon-squeezer. This juice is bought by the merchants for a few pence a gallon. As lime-juice decomposes very rapidly when exposed to the atmosphere in a tropical climate, and acquires a disagreeable taste in a few hours, unless the air is excluded from it, it may easily be imagined that the juice so obtained does not please the English consumer, even if it had not, as is sometimes the case, been adulterated with salt water by the negroes to increase its bulk. In fact, until the introduction of the Montserrat juice, lime-juice was not popular as a beverage, on account of the mawkish taste which, as explained above, it so often carried with it.

"In order to ensure a regular supply of juice of reliable quality, extensive lime plantations were established more than twenty years ago, by Messrs. Sturge, of Birmingham, in the Island of Montserrat; where alone is the lime systematically cultivated on a large scale for the purpose of supplying juice as a beverage to the English market.

"This juice is brought over in large casks to this country, when, after being allowed to settle, it is clarified and bottled."

The writer also states that—

"Since the introduction of Montserrat lime-fruit juice, lime-juice or cordials prepared therefrom have undoubtedly become most popular beverages, and the fact that over 80,000 gallons are imported yearly from Montserrat shows the estimation they are now held in, and the important trade that has been developed."

CINCHONA.

ANALYSIS OF NILGIRI-GROWN CINCHONA BARK.

THE Madras Government some time ago forwarded to the Secretary of State consignments of cinchona bark, from their estates at Naddewatum, Dodabetta and Pykara, from which quinine and other alkaloids were to be manufactured on their behalf. These barks were made over to Mr. Whiffen, the well-known pharmaceutical chemist in London, and the analysis yielded the following results :—

Description of bark.	Quinine sulphate per ct.	Cinchonidine sulphate p.ct.	Cinchona alkaloid p.ct.
Renewed crown bark...	5·57 to 5·71	0·41 to 0·48	0·12 to 0·31
Mossed ...	4·06 to 4· 3	1· 4 to 4· 5	0· 2 to 0·24
Natural ...	3· 6 to 3·42	1·02 to 1·21	0·15 to 0·23
Renewed red bark ...	3·04	2·32	1·84
Mossed bark ...	1·71 to 2·09	2·15 to 2·32	1·68 to 2·39
Natural ,, ...	1·28 to 1· 2	2· 8 to 3·57	1·14 to 1·63
Root ,, ...	1· 3 to 2·09	2· 1 to 2·15	2·39 to 2·57
Branch ,, ...	0· 8 to 0·66	1· 5 to 1·35	0·47 to 0·51
Renewed scraped crown bark ...	4·34	0·37	0·21
Natural scraped bark...	1·81	0·75	0·06
Branch crown bark ...	0· 7	0·16	0·04

The total of product obtained by manufacture was as follows :—

Quinine sulphate	1,467 lbs.
Cinchonidine sulphate	345 ,,
Quinidine ,, ...	40 ,,
Cinchonine alkaloid	208 ,,
Febrifuge	2,236 ,,

Total charges on account of the bark sent amounted to £3,352-0-9, distributed as follows :—

	£.	s.	d.
Freight, agency, &c.	721	9	3
Manufacturing charges	2,604	11	0
Fire Insurance of bark at factory... ...	26	0	0

CINCHONA BARK.

MESSRS. ROBINSON and Dunlop have received for sale a number of small lots of Hakgalla Government bark—succirubra from trees 18 years old, officinalis 10 to 12 years old ledgeriana 3 years old, and calisaya 5 years old. The results of analyses are very poor, and one may thereby be convinced that after 6 and 8 years the alkaloids do not increase with age. They are

Succirubra thick stem quill from 8 years old trees—sulph. quinine	2·41
Total alkaloids ...	5·62
Do. stem and branch chips—sulph. quinine	1·72
Officinalis broken bold quill from 10 to 12 years old trees—sulph. quinine	2·00
Total alkaloids ...	3·21
Do. stems and branch chips—sulph. quinine	2·22
Calisaya stem and branch chips from 5 years old trees—sulph. quinine	1·35
Ledgeriana stem and branch chips from 3 years old trees—sulph. quinine	2·63
Total alkaloids ...	4·53

This is certainly a very curious result, but we think part of the explanation in the case of the succirubra bark is found in the unfavourable altitude and climate of Hakgalla (6,000 feet) for red bark, for trees 18 years old grown in the Wynaad gave much better results. At the same time, Broughton established on the Nilgiris the decrease of quinine after the 6th year of succirubra trees, although the total alkaloids increased up to the 9th year when they also positively declined. Mr. Broughton's conclusion was that the trees in question had passed the age of maximum yield, and he accounted for it by the growth of the bark at this age being mainly an increased development of liber fibres, and not cellular tissue. He also considers it as probable that a waste of the alkaloids commence from the first year, but is counterbalanced by the rapid simultaneous formation of alkaloid in the earlier years up to the 9th, when the formation becomes less active, and deterioration is the result.—The great value of ledger bark is strikingly shewn in the above table. We shall be glad if planters with experience of old trees will make the analytical results known.—*Ceylon Observer.*

FORESTRY.

IN the number of the *Forstliche Blätter*, of Leipsic, appeared an article entitled, "Relation between the frequency of thunderstorms and the mineral constitution of the soil," from which are taken the following observations, interesting to the student of Forest Science :—

"The Principality of Lippe-Detwold has an area of 20,000 square miles, and is divided into nine forest cantonments.

"Mr. Feye, Forest Inspector, made from 1874 to 1880 observations in regard to thunderbolts striking trees of the forest during that time, the results of which are embodied in the following table :—

Year.	Number of thunderbolts.	Number of trees struck.
1874 ...	... 14 ...	 14
1875 ...	... 12 ...	 17
1876 ...	... 28 ...	 37
1877 ...	... 37 ...	 42
1878 ...	... 21 ...	 21
1879 ...	... 20 ...	 40
1880 ...	... 56 ...	 67

During the last three years the observers gave attention to the different kinds of trees which were stricken. These were—oaks 77; beeches 14; other broad-leaved trees 4; resinous trees 44; oftener than once it happened that an oak and a beech have been struck at once by the same thunderbolt. From these data may be deduced with precision the danger to which each kind is exposed of being so struck if the number of trees belongling to each group were known. If we substitute for this the area occupied by each kind of tree we find :—

Area.	Hectares.	Proportion per cent of area.	Proportion per cent of thunderbolt.
Oak woodlands ...	1860	10·5	60
Beech woodlands	11,840	70·	11
Other woodlands	260	1·5	3
Coniferous woods	3,230	18·	26
		100	100

From which it follows that the risk of being struck by a thunderbolt is, for the oak 60 by 10·5 = 5·7, while it is only 0·16 for the beech, 2· for other broad-leaved trees, and 1·5 for resinous trees. In other words, representing the risk for the beech as 1, it is 34 for the oak, 12 for other broad-leaved trees, and 9 for resinous trees.

"There is, then, a foundation of truth for the old saying that the beech is never struck by lightning; and if the ancient Germans honoured the oak as the dwelling-place of the God of Thunder, may it not have been that, living always in the open air, they may have remarked the preference of the lightning for this kind of tree?

"The observations made from 1874 to 1880, in the 18,000 hectares of extensive forest in the Principality have been grouped thus according to the nature of the ground, with the following results :—

		Percentage of area.	Per cent. of thunderbolt.	Risk for kind of land.
Calcareous lands	... 4,735	26·	3	0·11
Kuper marle	... 5,640	31·	10	0·32
Argillaceous lands	... 3,160	17·4	13	0·75
Silicious land	... 2,365	13·	21	1·61
Hard clay	... 2,280	12·6	53	4·20
		100	100	

The numbers in the last column have been obtained by dividing those of the third column by those of the second; and they show in regard to different kinds of lands analogous to those which we have found to be the case in regard to different kinds of trees. For once that the lightning struck calcareous land it struck on a corresponding area four times marl land, seven times argilaceous land, 14·5 times silicious land, and 38 times the hard clay (*Lehm*). Countries, then, in which calcareous lands predominate are less exposed to damage by lightning than are those which consist of hard clay (*Lehm*); and the editor of the *Forstliche Blätter* remarks that on calcareous land, the oak is in general much less abundant, while it is the species of tree predominating on the argilaceous *Lehm*, or mud land, and that it is in this fact we must look for the cause of the difference observed, rather than in the mineral composition of the soil. The deductions made would doubtless require to be confirmed by new observations, but they indicate at least in

what direction these researches must be prosecuted, and these commend themselves especially to observers in forest meteorological stations."

A COPAL FOREST.—The British Consul at Mozambique has recently reported the discovery of a considerable tract of copal forest. The forest is fully 200 miles long. It is a belt which runs parallel with the coast, and is midway between the coast and the first range of mountains. From Inhambane it is nearly 100 miles to get right into it. This distance is a little great, and may retard its being opened up, but its discovery adds to the known wealth of the district. "The native name of this gum," says the Consul, "is 'Stakate' and 'Staka.' The Zulu name for gum is 'Inthlaka'. The name 'Stacte,' mentioned in Exodus xxx, 34 (this is believed to be the gum of the Storax tree, *Styrax officinal*), would be pronounced as the above-mentioned native name. The tree domineers over all, and, standing in any place overlooking the forest, you see here and there trees growing as it were in a hayfield. The gum has a beautiful odour if pounded and burned, also if boiled in a pot of water." The ordinary gum copal tree of the mainland of Zanzibar and Mozambique, though as a rule lofty, is by no means of the striking character here indicated.

THE TEACHING OF FORESTRY AT THE CENTRAL FOREST SCHOOL, DEHRA DOON.

FORESTRY being an art founded entirely on the observation of natural phenomena and the correct application of principles deduced therefrom, one of the most certain tests of a forester's aptitude for his profession is evidently the composition of a paper on some sylvicultural subject, to which he has devoted special attention. Accordingly, at the Central Forest School at Dehra Doon, it was decided to require the students, who were just completing their probation during the past session, to write an original essay on some subject selected by themselves, the essay to form an integral part of the final examination in forestry. This decision, for reasons which could not be helped, was only communicated to the students a fortnight before the examination, so that they had not the advantage, almost indispensable it must be admitted, of having previously followed out a connected series of observations all bearing on the one subject selected. Nevertheless, the essays are, I think, a fairly satisfactory proof of the progress made by the men, and as they will not only serve to give to the general public some idea of what we have been teaching at the Central Forest School, but at the same time also help to show to Indian foresters, the class of men we are preparing for the subordinate grades of our department, I send you selections from them for publication.

Critical readers will please to remember that these men form the first batch, who have gone through the entire course of instruction followed at the school; and that it is not from among the alumni of our Universities, men possessed of a high degree of general culture, that we can draw our recruits.

The men are all natives, and it would hence be superfluous for me to add that English is a foreign tongue for them.

The matter concerns us much more than the style and phraseology. I have, therefore, corrected the language of the extracts in so far as to make it intelligible English: the substance remains unchanged.

DEODAR IN KULU.

BY MIAN MOTI SINGH.

FORESTS in which deodar is the prevailing tree are generally found on moist loamy soils. The deodar affects northerly and westerly aspects most, although it is not seldom met with on other aspects. Indeed, the aspect it selects varies, as a rule, with the altitude at which it grows. For instance, between 4,000 and 6,000 feet above the sea the tree grows gregariously on northerly and westerly slopes, and less commonly on easterly slopes, while *Pinus excelsa* very often forms pure forests on southerly aspects. Above 6,000 feet, on the other hand, it is on easterly and southerly aspects that deodar flourishes, growing there frequently almost pure, northerly and westerly slopes being occupied by the Himalayan spruce and silver firs.

The needles of conifer in the Himalayas form, when not burnt by fire, or triturated under the feet of cattle, a thick loose covering of undecayed vegetable matter over the soil. Deodar seeds that fall on such a covering, although they germinate freely enough, generally fail to extend their tap root through it into the soil below, the result being that they are either washed away with the dead leaves by the spring rains, or are killed by drought. On the other hand, young seedlings of *Pinus excelsa* develop a tap root capable of piercing this loose mass of undecomposed leaves, and forcing its way into the soil, where they thus fix themselves firmly.

The Himalayan spruce generally produces from two to three crops of seed during the interval between one seed year of deodar and another. And hence, when these two species grow together, this circumstance alone, irrespective of some others, gives the former species a decided advantage over the other.

The advantages of having oaks growing with deodar are many. I may mention some of the principal:—First, the deodar by itself, or associated with other conifers, cannot form a complete leaf canopy. When oaks enter the crop, these broad-leaved trees fill up all the intervals between the crowns of the cedars, without, however, diminishing the number of the latter. They thus force and hasten the natural pruning of the cedar boles, and they increase the production of the soil. Secondly, none of our oaks attain anything like the height of deodar, so that the former constitute a true undercrop, making growth on their own account, and pushing up the latter. Thirdly, and lastly, the mixed crop so obviously forms a much more complete cover over the ground, the soil being thus continually protected and improved.

The people in the Himalayas prefer the leaves of oaks as fodder to those of any other trees, and even to the various grasses themselves. Oaks are also cut for fuel before any other species. Oaks are, therefore, very heavily lopped, and are hence kept down or destroyed, so that where they might grow usefully with the deodar, pines and small broad-leaved trees remain the only effective, but comparatively inefficient, allies of that valuable tree.

It is a well known fact that young deodar is greedily eaten by sheep and goats; and that, although the stem of young seedlings is remarkably elastic, the heavy buffalo tramples down and crushes thousands of them under his broad cloven foot. I would, therefore, exclude grazing from every area that is completely under our control But when the undecayed layer of dead needles is so think as to impede reproduction, I would admit cows in order to triturate the whole mass, facilitate its decomposition, and render it more compact.

Fires are not an annual occurrence in deodar forests, owing to the great altitude at which they often occur, and which preserves the moisture of the soil all the year round. But as the needles of conifers decompose very slowly, and are very resinous, they form a thick layer of highly combustible material, which, when once ignited, burns fiercely. Hence forest fires, when they do occur, are difficult to put out and do great damage. The only way to check or keep out fire is to trace fire lines, which should be kept clear of all combustible matter, and especially of cones. Unfortunately we have no deodar forests in the Punjab, which are thus protected. —*Indian Forester*.

THE GARDEN.

The Action of Manures on Fruits.—Cultivated plants are the inheritors of whatever benefits or disadvantages they may have derived from their predecessors. The thing is obvious enough to those who look on plants from an evolutionist's point of view; and the practical outcome is that, except under special circumstances, or for some special purpose, it is best, in our attempts to improve upon what we have got, to deal with a plant that has been in cultivation for a long time, and so avail ourselves of its stored-up inheritance. It would be a long uphill work to start afresh with the crab or wild pear, for instance, although for the sake of getting a new "break" or more robustness of constitution it may be desirable sometimes to begin again at the beginning, or at least to infuse some less conventionalised blood into our plants, if we may so speak. A curious illustration of the contrast between the wild and the civilised condition is afforded in Professor Goessman's paper on "Mineral Constituents in Plant Growth," in the *Transactions of the Massachusetts Horticultural Society*. The Professor has been experimenting on the difference in chemical composition between vines unmanured and vines manured. In the course of his experiments he analysed the juice of a wild vine (*vitis labrusca*) grown without manure. And the juice of the same vine when treated with manure. At one bound the sugar rose from 8·22 per cent in the wilding without manure, to 13·67 per cent in the same wilding appropriately fed. This shows the advantage of the manure. But now, looking to the analysis of the cultivated variety (*Concord*), we find that in its juice, even when unmanured, the sugar amounted to 13·89 per cent, so that the cultivated variety, without manure at all, yielded a larger percentage of sugar than did the wild form with ample manure. The increase of sugar is coincident with a large increase of potash, and a largely diminished proportion of lime. In the case of strawberries the wild unmanured variety contains much less potash, much more lime, much less magnesia, much more iron, and about the same percentage of phosphoric acid as the cultivated and manured variety. The wild strawberry, moreover, contains one part of acid to two of sugar, while in the cultivated varieties the proportion of acid is one to four or more of sugar.

INDIAN PRIMROSES.—In the last number of the *Journal of the Linnean Society* is an interesting paper on some undescribed and little known Indian species of *Primula* and *Androsace* by Dr. George Watt, who has paid great attention to the order both in Sikkim and at the herbarium at Kew. The number of species of *Primula* enumerated is twenty-four, and of *Androsace* six, and the enumeration is accompanied by some notes by Sir J. D. Hooker. Several of these plants will doubtless soon be in the hands of our cultivators, on which account we think it well to call their attention to the publication of this paper with its numerous illustrations.

THE PLANTS OF MADAGASCAR.—At the last meeting of the Linnean Society a paper was communicated by Mr. J. G. Baker, containing descriptions of a large number of new species of *dicotyledons* of the *gamopetalous* series of natural orders, gathered in Madagascar by recent English collectors, especially the Rev. R. Baron, F.L.S., of the London Missionary Society. The most interesting of these novelties is *Schismatoclada*, a new genus of *Rubiaceæ*, allied to cinchona. The other new genera are *Tetraspidum*, of the group of semi-parasitic *Scrophulariaceæ*, such as *Pedicularis* and *Melampyrum*, which turn completely black in drying, remarkable for its four shield-shaped one-celled anthers; *Forsythiopsis*, an erect shruby *Acanthaceous* genus, with flowers like *Forsythia*, and leaves not fully developed till after the flowers fade; and *Monachochlamys*, another genus of *Acanthaceæ*, allied to *Mendoncia* and *Thunbergia*, with numerous small flowers, each contained in a persistent spathaceous bract like the hood of a Franciscan monk. Of repre-

sentatives of well known European genera the present collection includes two species of *Anagallis* nearly allied to *Tenella*; two *Ajugas*, a *Salvia*, two *Micromerias*, three species of *Stachys*, five *Senecios*, three *Cynoglossums*, and a *Lysimachia*. The genera represented most largely are *Danais*, *Vernonia*, *Helichrysum*, *Gaertnera*, *Clerodendron*, and *Hypoestes*. There is a single species of the beautiful *Acanthaceous* genus,—*Strobilanthes*, which is almost restricted to Tropical Asia. There is a new *V nca* nearly allied to *Rosea*. Of endemic genera, known previously in the island, there are new species of *Aspilia*, *Epallage*, and *Oncostemum*. Of Cape types the principal are a *Lightfootia*, a *Halleria*, an *Alectra*, and two heaths of the genus *Philippia*.—*The Gardener's Chronicle*.

NOTICE OF BOOK.

The Field and Garden Crops of the North-Western Provinces and Oudh, with Illustration by J. F. Duke, B.A., F.L.S., and Mr. J. B. Fuller, Assistant Director of Agriculture and Commerce, North-Western Provinces and Oudh, purports to be the first of a short series in which it is proposed to describe the cultivated products of these provinces, and to furnish, in a convenient form, all the information on the subject that is likely to be wanted by the student of Indian agriculture, or by the administrative officers of Government.

It was scarcely to be expected that all that might be said on the field and garden crops of the North-Western Provinces could be said in about one hundred pages, it is needless therefore to say that several of the topics are most inadequately treated, from an agricultural and commercial point of view, notably that of hemp. The botanical part of the work so far as it goes leaves little to be desired. The student of Indian agriculture and the administrative officers of Government could, we imagine, easily obtain access to the various *Gazettes* of the several Indian provinces where much valuable information, agricultural and commercial, is stored up. In the *Field and Garden Crops* references to authorities or sources of information are confined to the botanical part of the book, and no use has been made of volume X of the North-West Provinces Gazetteer; it has not even been referred to as a possible source of knowledge. The illustrations, while fairly well executed, on the whole are either defective or obscure in almost every plate, and the want of colouring detracts considerably from the popular usefulness and value of the drawings.

MINERALOGY.

FROM Perak the *Penang Gazette* learns that recent prospecting has proved that the alluvial deposits of Perak are very rich and extensive; the several districts in which tin oxide is being mined are being opened gradually, each producing the mineral in high percentage and of good quality, the development of which by primitive methods affords large profits to the mine owners, which may be increased by the application of improved appliances. A great number of square miles of rich tin land are available for tin mining: several of the different valleys have been opened and are being mined for their produce of tin ore which varies from 1·5 to 60 per cent. The deposits in the Kiuta district at Tapan are very rich; and also at Chanduriong, where enormous lumps of tin oxide are produced.

LIGNITE IN SOUTH ARCOT.

SOME months ago, when boring for an artesian well in the village of Vargour (Bahour), eight miles south of Pondicherry, the auger, at 243 feet below the surface of the ground, came in contact with some lignite, the thickness of which was found to be 33 feet. The lignite was of a dark brown colour, passing into back, and showing at some places, small thin and bright particles; it was intermixed with iron pyrites of greyish colour, and we hear that the composition of it was as follow:—

Carbon	0·49
Hydrogen oxygen and azot	0·40
Ashes, &c.	0·11
Total ...	1·00

and its calorific power about one-half of that of coals. The artesian well in which the lignite was found is situated two miles north of the Ponnear river, and three-and-a-half miles from the sea coast inland, in the alluvial basin of the Ponnear river, which is separated from that of the Gengee river by a rise, under ground, of the tertiary formation, the ridge having a direction from west to east parallel to two rivers.

These two basins each form a part of the large alluvium existing between Meroanum and Point Calymere, and which is superposed to the tertiary formation outcropping at the Red Hills near Pondicherry and at Mount Kepper, near Cuddalore, dipping again near Verdachelium to reappear near Tanjore. This tertiary formation has below the alluvium four principal depressions, which have been filled up by the disintegration of the tertiary formation itself and of the gneiss westwards, and have thus formed the alluvial basins of Gengee, of the Soucar, of the Vellar, and of the Cauvery rivers. The strata which have filled up the tertiary basins are generally composed of the same materials as proved by the thirty borings already made in a line parallel to the coast. They consist of the black clay deposited by the sea, of sands, pebbles, argillaceous mixtures and clays of different colour, from pyrites, and lignites sometimes in large quantities. In every boring which has been made lignite was found in a more or less advanced state of transition and of variable thickness, the most remarkable deposit being that found at Vargour. From the above it may be surmised that if lignites are found in so many places and in such quantities, they can be found somewhere in those alluvial soils in important deposits. To return to the Vargour boring, a gentleman, (Mr. Delonole), who was passing through Pondicherry at the time the lignite was tapped, and who had occasion to examine this product, obtained a lease for mining the deposit, and started a Company for the purpose. After having the specimens sent to Europe and analysed, the Company has despatched to India two mining engineers, with their staffs and boring apparatuses, for ascertaining the extent of the deposit, and the advisability or not of working out the Vargour lignite. These gentlemen are expected by the next French steamer.

If mining operations are undertaken, they will be executed without much difficulty, as it will be only necessary to pass the surface water sheet; from this to the bed of lignite below there is no other water-bearing stratum. Whether the 33 feet of lignite extends over a large area or not it is impossible at present to say, and as nothing is yet known of the future market price of this combustible, the future prospects of the enterprise cannot be ascertained until the report of the survey by the mining engineers has been published. If the combustible found at Vargour proves worth mining, this will encourage others to search for lignite beds, which may probably exist underground in the alluvium mentioned above. P.

SERICULTURE.

IT may not be generally known that in the valley of the Brahmaputra the respectable Hindoo is accustomed to walk in silk attire. This is no product of French or Chinese looms, but strictly of home growth and manufacture. Assam is happy in the possession of two indigenous varieties of silk worm, which prefer a simpler and more inexpensive diet than the traditional mulberry. One kind thrives upon a common forest tree; the other selects, out of the large range of vegetable life at its choice in Assam, the castor-oil plant as the food in which it luxuriates. The former species yields a silk with a beautiful yellow gloss, while the castor-oil worm spins a thread which can be woven into one of the most durable materials hitherto discovered. If neither sort of silk is of the very finest quality, both are admirably adapted for working into silk plushes and similar compound fabrics. When we add that the supply can be increased to almost any extent, it would appear that there is nothing more to say except that the silk industry in Assam is bidding fair to rival tea in importance. But the facts, unfortunately, are far otherwise. Both the production and the manufacture of silk have for years been steadily declining. The loom used to be an indispensable article of furniture in the old-fashioned Assamese household, and no girl had a chance of getting married unless she was able to weave garments for herself and her husband. But this laudable domestic custom is gradually dying out; Manchester piece-goods have almost hushed the household music of the loom by the banks of the Brahmaputra, as in the shires of England; and with the decay of the local market the breeding of silkworms has simultaneously decreased, while the price of silk has nearly doubled. The only hope for the trade now seems to be the creation of a market in France or England, and this must depend to a great extent upon the action of European capitalists, some of whom are already interested in the silks of India. At present the silk question in Assam—and indeed, it is believed in Bengal generally—presents this extraordinary aspect, that though the cost of feeding the silk worms is really insignificant, and the facilities for the extension of sericulture are practically limitless, yet the cocoons of one of the best species cannot be got in the

market at all, while those of another cannot be got at the price which European manufacturers are prepared to pay. This is a state of affairs which cannot be altered without patience and capital, but anybody learned in silk, and sufficiently qualified in these two respects, ought to make a good thing out of the Assam silk business after a few years.

SERICULTURE IN CEYLON.

A CORRESPONDENT sends us two very nice-looking cocoons, to shew what is being done in Galle, and he writes :—

We are indeed very glad in being able to say that Father Palla has experienced considerable success in the culture of silkworms in this country. The successful results which have attended his efforts in this industry for the last three years convince us, despite the adverse views of some as to its success, that the culture of the silkworm can be carried out, beyond a doubt, to such a great advantage in this country, as to be made a very remunerative and profitable industry, if conducted with due attention and care. Father Palla's object in attempting this enterprise was, as we see, for no other reason than that of proving to the colony that silk production can be carried to undoubted success in this country; and his successful experience for upwards of three years in this enterprize, we dare say, warrants him in saying that he has realized the object he aimed at. Although it was said by some, whose experience in this industry falls short of the mark, that the mulberry plant, the chief aliment of the silkworm, does not grow freely in Ceylon, yet we have no hesitation in saying that Father Palla's successful experience in the cultivation of the plant, places us beyond the shadow of a doubt that the mulberry plant grows very freely in any place in Ceylon. Mr. Geddes also concurs in this opinion, but it must be conceded that it does not thrive so luxuriantly as it otherwise would in somewhat colder climates than Ceylon; but however this may be, it thrives so luxuriantly in Ceylon, as to ensure success in the culture of the silkworm, and Father Palla's mulberry plantation in Galle is a proof of this. It was also said that the silkworm eggs of the second production become spoilt and useless, and that a fresh supply of eggs is required to be imported from Japan or elsewhere. But we have seen the eggs of the fifth production, and from our own personal observation, we can say that they appear to be of superior quality to those of the primary production, and moreover we learn from letters received by Father Palla from Germany, Italy, England, &c., that the cocoons sent by him from Ceylon were so much appreciated and admired, as to render it desirable for them to apply to him for eggs.

First, it is essentially necessary, before the rearing of silkworms in sufficient quantity for commercial purposes can be successfully attempted, to have a good plantation of mulberry. This is of paramount importance to ensure success in the enterprize.

Secondly, an apartment or room as in India is much needed to keep the worms safe from being exposed to the danger of easily falling victims to lizards, scorpions, ants, and such other plagues. This, we say, as it has been said to us from Father Palla, who has experienced such destruction.

Thirdly, it must be also one of the main considerations with the sericulturist to secure the services of an expert in the rearing of the silkworm, *i. e.*, one who has especial knowledge in the culture of the worm—"education" as it is called of the worm; for practical knowledge is more needed than theory for carrying on the business successfully. It is therefore no wonder that those who have overlooked those precautions have met with ill-success in the enterprize.

We are glad to hear that several persons, following in the wake of Father Palla, are devoting much time and care to this pursuit. We wish them every success in their endeavours, as with a little experience it can be made a very profitable industry for the natives of this country. It will also give great pleasure and satisfaction to Father Palla, to hear of their success, and to know that his endeavours to give the natives of this country the benefits of an industry so long overlooked have not been fruitless.

There can be no doubt that the mulberry flourishes in Ceylon, and Father Palla's experiments prove that the silkworm can be propagated here to the fifth generation. The commercial question then hinges on an abundance of cheap labour. In the great silk-producing countries, Italy, Japan, China, &c., much of the work is done by the women and children of families. It would be a great step in advance if women and children in native families here would devote themselves to the pursuit.—*Ceylon Observer.*

TEA.

THE following is a description of Mr. C. Shand's Patent Tea dryer :—

The barbacue-shaped steam-heated tea-dryer is the cheapest, most economical, and safest drying machine. As this machine can be made any length and width, the quantity of leaf which can be manufactured is only limited by the extent of drying surface. One, five feet wide, and fifteen feet long, will admit of about forty pounds of tea being spread as thinly as on sirocco trays, and, if heated to one hundred and fifty degrees Fahrenheit, would dry a maund per hour. The steam for heating thin galvanized iron drying surface is generated in the space (3 inches) between it and the thin boiler plate bottom. The machine, which is made steam-tight, is partially filled with water, and placed on a fire stove. It is evident that a comparatively small quantity of fuel will generate sufficient steam to heat a large surface, especially if the smoke flue is placed under the whole length of the machine. As it is impossible to fire-burn the tea, dried by the steam-heated dryer, the enormous advantage of being independent of the care and judgment of coolies, and of the necessity of uninterrupted European supervision, is too evident to require comment.

Mr. Shand says :—It is not intended to sustain any pressure of steam, the drying surface cannot easily be heated over 150 degrees (?)

As a matter of course, the tea takes a longer time to dry than when made by siroccos, in which the temperature is maintained at 275 degrees, but the extent of drying surface available makes this a matter of secondary importance.

Mr. Shand does not mean that no care or attention is required to keep up fire and supply boiling water periodically from a cistern placed over the flue; but it can be understood that the same care, judgment, and observation is not required to dry tea at a comparatively low temperature as at a very high one; for instance, it does not injure coffee to allow it to remain on the barbacue after it is thoroughly dry; but put it in a roaster, and what care and judgment is not required to perfect the roasting! No doubt, by the use of siroccos and other modern appliance, the risk of fire-burning is now greatly diminished, but these still require great care in shifting the trays and watching the thermometer. This constant watching is obviated by the use of Mr. Shand's machine, and all the superintendent has to do is to feel when the tea becomes crisp and dry; he has the security that, if this is neglected to be done at the moment it is sufficiently dry, no injury takes place by its remaining on the heated surface.

The machine is especially adapted for redrying tea before packing, this being an operation carried on at a low temperature, and requiring a good deal of care.

There are, it is well known, two difficulties connected with the proper manufacture of tea, requiring at present the constant supervision of the superintendent: these are fermentation and firing. If the necessity of closely watching the latter can be dispensed with, it gives the superintendents more time to direct the fermentation, on which the colour of the infused leaf, and consequently the value so greatly depends.

TEA AND CLIMATE IN INDIA AND CEYLON.

THE *Indian Tea Gazette* in noticing the discussion on the probable rate of bearing per acre of tea in Ceylon, very naturally denounces "Cha's" estimates of 700lb. for low estates and 400lb. for high, as exaggerated. Time will shew; but no time is needed to elapse in order to shew the incorrectness of the premises on which the Indian editor argues. He states: "perhaps Darjeeling and the Dooars would best represent the high and low elevations, respectively, at which tea can be successfully cultivated in Ceylon; *and the climatic conditions of the places named are almost identical.*" The meaning of the passage we have italicised is, of course, that the climate of the Dooars is identical with that of the low country of Ceylon in which tea is cultivated, and that the climate of Darjeeling is the counterpart of that of our hill country. To shew how baseless this statement is, we need merely mention, that at this moment and always in the season between November and March, the heavily pruned tea of the Eastern Himalayas, is enjoying the rest of a very pronounced winter, while it is in those very months that tea in Ceylon yields its most luxuriant flushes. The difference of climate is all that is implied in the facts that while Darjeeling and the Dooars are in the interior of a vast continent and on or at the foot of the most gigantic mountain system in the world (its very name signifying "The Abode of Snow,") and 27° north of the equator: Ceylon is an island, twenty degrees nearer the equator than Darjeeling and the Dooars and in the track of both monsoons. The climatic conditions, therefore, so far from being identical are about as opposite as well can be. Warmth and moisture are the prevalent characteristics of our Ceylon climate. Frost is so rare a phenomenon, even on the most elevated forest-land on which tea is cultivated in Ceylon—Oliphant estate, above Nuwara Eliya, to wit—as to be not worth taking into account, while devastating hailstorms, such as frequently play havoc with tea in Northern India and Assam, are utterly unknown in Ceylon. Such cold as we experience at this season of the year is powerless to check the growth of tea, and our winter, as far as tea is concerned, is in the heavy rains and strong winds of the south-west monsoon months, June—August, when the bushes are pruned. While in most of the tea districts of India the vast bulk of their rainfall occurs in from four to six months, ours is fairly distributed over the year. Indeed the objection offered in the experimental era of the tea enterprize in Ceylon was our chronically wet climate, and there can be no doubt that in a good many places, on the hills, the process of "withering" is rendered difficult by the prevalence of rain and mist. This is a difficulty not unknown in Darjeeling in the months, June—September. Had the editor of the *Tea Gazette* claimed for Darjeeling and especially for the Dooars, a more fertile soil than Ceylon can generally shew, we could better understand the argument. But we have good tea soil in a healthy climate. Into the Terrai at the foot of the Darjeeling hills the *debris* of the Himalayas have been pouring, perhaps for thousands of centuries, so that the rich black soil is, in places, forty feet deep. The Dooars have much the same conditions of soil and, unhappily of climate. All places at the base of mountains in India are insanitary, and even up to 3,000 feet, fever is the frequent result of

a climate made up of half the year very heavy rain and for the next half practically none. We are now at the commencement of our dry season in Ceylon, and our hill climate is simply delicious, being kept healthy by genial showers of rain at intervals rarely or never one month apart. In soil alone, therefore, if even in tea soil, is Ceylon inferior to India. Experienced Indian tea planters, like "*Cha*," have after sufficient comparison, given the palm of superiority to Ceylon, and Mr. Sandison, after having cultivated tea and contracted fever in Assam, and visited Darjeeling and all the other great tea districts of India, states decidedly that he saw nothing better than what exists in Ceylon for successful tea production.—*Ceylon Observer.*

TOBACCO.

TOBACCO CULTIVATION IN THE WEST INDIES.

FOR some years past the superior quality of the tobacco grown in Jamaica has been steadily forcing itself on public recognition, and Jamaica cigars seem likely to take rank alongside those produced in Cuba, which, taking their name from the capital of that island, have come to be recognised as the type of excellence in this particular form of the "fragrant weed." The cultivation of tobacco was an industry of some importance in the Lesser as well as the Greater Antilles, but it has died out in the former, though that is no apparent reason why the cultivation of the plant should not be revived there. The plant has been introduced from Cuba into the Bahamas, where it promised excellent results—although it would appear that, probably owing to the expense of initiating the industry, the Government has not continued the experiments—and Governor Robinson, struck with the similarity between the climate, soil, and rainfall of Cuba and those of St. Lucia, has induced the Legislative Council of the latter island to vote a sum of money with the object of introducing the "new product" into the colony. A "Tobacco Committee" has been pointed to enquire into the subject, and the result of their in gation is embodied in a report which has just been Some seed of the "best Havana tobacco"—procured, esting to note, from the Botanical Gardens of Jamaic trusted to four gentlemen, who undertook to give it a fair trial; and although it is too early yet to judge of the eventual results of the experiment, the seed is reported to have germinated and to be progressing favourably, and there seems every reason to anticipate a successful result. There is in St. Lucia an abundance of soil of a suitable nature, with ample shade and rain, and many different "aspects," while the whole climate and physical features of the island approximate very closely to those of Cuba. The principal difficulty, indeed, in the way, seems to lie in the proper curing of the leaf. Sir Joseph Hooker endorses Governor Robinson's statement, that the finest tobacco in the world may be spoiled by improper or inefficient curing; and he quotes an instance in which ten bales of Ceylon tobacco, sent recently to the London market as an experiment, fetched a low price in consequence of the centres having been decomposed during the voyage, through some defect of curing or packing. With the care with which Governor Robinson and the authorities of St. Lucia have gone into the matter, there is little fear of such a mistake being made there, and their experiment will be watched with interest in the colonies. Tobacco requires a soil rich in potash, and while calcareous and clayey soils are to be avoided, alluvial lands on the banks of streams, not too wet, are most favourable. Plenty of manure is required, as the plant rapidly exhausts the soil; but chlorides must be scrupulously avoided. Slow desiccation, without exposure to sun or wind, and sound fermentation, are the two main points to be observed in the preparation of the leaf for the market.

NOTICE

TO MANUFACTURERS,

AND

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Full particulars can be obtained from the Office of the Joint-Secretary to Government, Punjab, Irrigation Branch, Lahore, and information, regarding the Water Power available at the various sites and their local advantages, can be obtained from the offices of the Superintending Engineer, Bari Doab Canal, Umritsur, and Superintending Engineer, Western Jumna Canal, Delhi.

By order,

R. HOME, LT.-COL., R.E.,
Offg. Joint Secy., Govt., Punjab,
P. W. D., Irrigation Branch.

Lahore, January 24, 1882. 47

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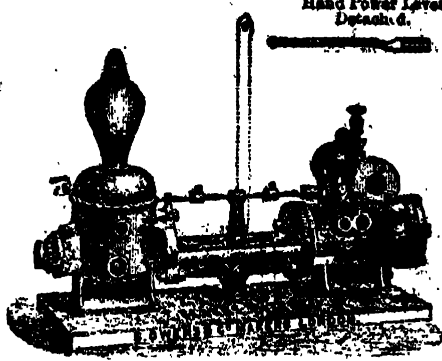
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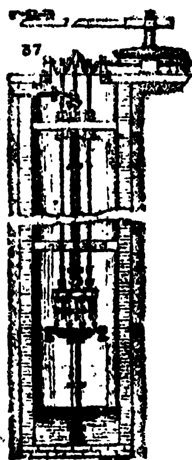
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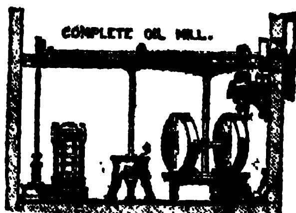


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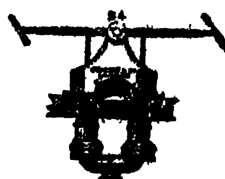


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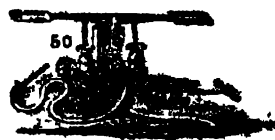

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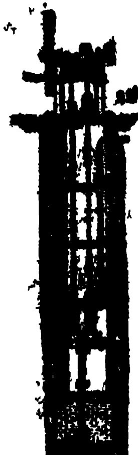
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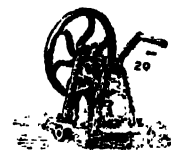


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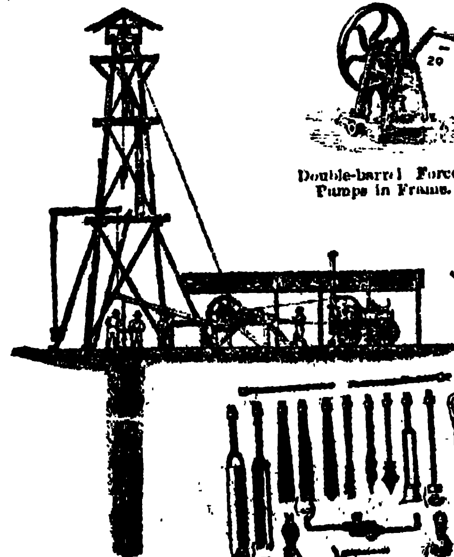


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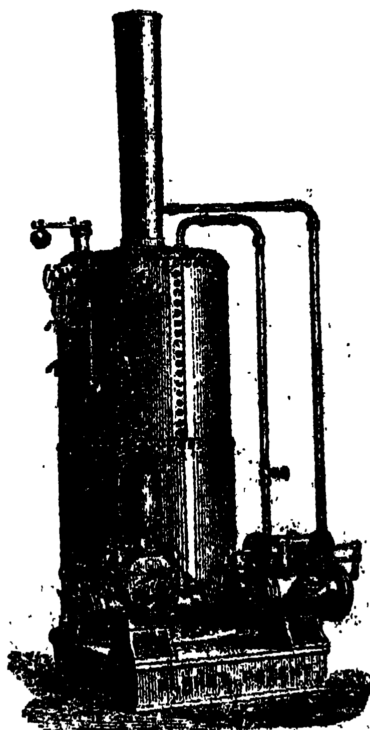


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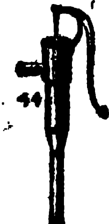




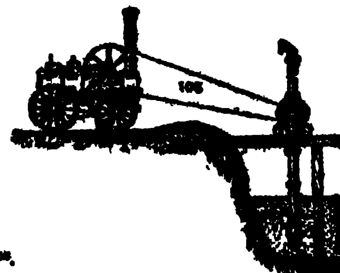
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[VOL. VIII.] CALCUTTA,—THURSDAY, MARCH 1, 1883. [No. 3.



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NOTICE.

SUBSCRIBERS to the STATESMAN, FRIEND OF INDIA, *and* INDIAN AGRICULTURIST *are informed that arrangements have now been made by which these journals will for the future be published under the general superintendence of the undersigned.*

All communications concerning the general business of the STATESMAN AND FRIEND OF INDIA *Office, Advertisements, and Subscriptions to the* daily STATESMAN AND FRIEND OF INDIA, weekly FRIEND OF INDIA AND STATESMAN, *and* INDIAN AGRICULTURIST, *should be addressed to the MANAGER.*

All communications regarding literary matter should be addressed to the EDITOR *of the paper for which it is intended.*

WILLIAM RIACH.

June 13th, 1881.

CONTENTS:

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGMENTS.

Suggestions regarding Forest Administration in the Madras Presidency. By D. Brandis, F.R.S., C.I.E., Inspector-General of Forests to the Government of India.

Suburban Villas and Residential Farms in Kattyawar. By Major H. L. Nutt, Bombay Political Department. Printed at the Educational Society's Press, Byculla, Bombay.

Agricultural Banks and Supplemental of Legislation for Agricultural Relief. By A. P. W., Medical Hall Press, Meerut.

The Indian Forester (Supplement).

Indian Meterological Memoirs Vol. II., Part I.

Report of the Director of Public Instruction, Bombay Presidency.

CORRESPONDENCE.

CAWNPORE FARM EXPERIMENTS.

TO THE EDITOR.

SIR,—In the February number of your paper a contributor, J.P.P., gives some startling deductions from the figures in Mr. Fuller's recent report on the Cawnpore Farm experiments, and arrives at the conclusion that the soil sample, of which Mr. Fuller publishes an analysis, must either have been artificially enriched with nitre and wood ashes before transmission to Roorkee, or the Roorkee chemist must have made an erroneous analysis. In justice to "the Roorkee chemist," Dr. Murray Thomson, allow me to point out that he had nothing to do with the analysis. The sample of soil was collected by Mr. Fuller himself, and sent direct to me ; consequently we alone are responsible for any error that may be discovered in the results.

To support the wood-ashes theory, your contributor makes a curious calculation, from which it appears that, according to the analysis, there must have been nearly 4,000 pounds of free potash in the upper three inches of every acre of soil. In the published analysis there is nothing whatever to suggest the presence of any free alkali in the soil, and if J.P.P. will take the trouble to look at the figures again, he will see that the potash, on which his calculation is founded, was contained in the hydrochloric acid extract, and was therefore probably derived (except so much of it as was contained in nitre) from the zeolitic constituents of the soil, which are decomposed at once by hydrochloric acid, but yield very slowly to the action of the acids in the soil. At once, therefore, more than half the total of saline constituents made out by J.P.P. is shown to have no existence, and the total would not look so great as it does if the results were shown all through in pounds instead of grains. If J.P.P. will take the trouble to go over his calculation again, he will find that in the portion a foot square and an inch deep, which he takes, there is only 0·027lb. of nitre (supposed to be potassium nitrate), since the soil contains all parts of anhydrous nitre acid in 10,000, and its specific gravity is about 2·34. Whether wheat would germinate in such a soil, or not, I do not know ; there is no apparent reason why it should not, but at all events, nobody expects it to do so. The soil sample was collected in the hot weather after the reaping of the *rabi* crop, when, for upwards of six months, capillary attraction and evaporation had been concentrating soluble salts in the surface layers. At the end of the rains, when wheat is sown, these salts have been washed down, and disseminated through a depth of perhaps ten or fifteen feet, and if this sample had been collected at that season, it would probably not have shown a twentieth part of the proportion of soluble salts found in it in the hot weather.

The percentage of anhydrous nitric acid found in this soil is doubtless much greater than is usually met with in cold countries, where the nitrogen of the soil exists chiefly in organic combination and in the form of ammonia. Thus, Mr. Robert Warington (*Journal of the Chemical Society* for August, 1882) finds that the upper nine inches of the air-dried soil of Sir J. B. Lawes' experimental farm at Rothamsted contains on the average only 6·77 parts of oxidized nitrogen per million—a quantity which looks exceedingly minute in comparison with the 285 parts found in the surface layers of the Cawnpore soil after six months' concentration by evaporation. But then the drainage water at Rothamsted actually carries off in the course of a year more nitrates than are ever present in the upper nine inches of soil at any given time. On the mean of the six years, 1877-82, the loss of oxidized nitrogen in the drainage water amounted to 20·17 kilogrammes per acre, or 7·14 grains for every square foot of surface. Taking the specific gravity of the soil at 2·5, the weight of a block a foot square and nine inches deep would be about 820,800 grains. Hence, since nitrification goes on chiefly at the surface, 8·7 parts of oxidized nitrogen are removed from every million of surface soil while the soil contains only 6·77 parts at any instant of time.

It is evident, therefore, that the nitrates of Indian soils, in which there is no subsoil drainage, should not be compared with the minute and fugitive proportion of nitrates found in England, but with the whole of the nitrogenous constituents of the English soil, since Indian soils like that at Cawnpore contain practically no ammonia and no organic nitrogen. Compared in this way with any average wheat soil of Europe that of the Cawnpore farms shows to great disadvantage.

Those who know most about agricultural chemistry put the least trust in the results of analysis, however carefully performed, as a measure of fertility of a soil. To begin with, much depends on the conditions under which the sample is taken, the quantity of soluble salts near the surface, after a prolonged drought, differing enormously, for example, from that found after heavy rain. Then the chemist is quite unable to reproduce in his laboratory the conditions of the field or anything approximating to them, time alone being a most important condition which has to be disregarded. The quantities of potash, lime, &c., found in a hydrochloric acid extract probably represent fairly enough the total ultimate fertility of the soil in these constituents; but while the chemist gets them into solution in an hour, they may require centuries for solution in the field, and while they remain in insoluble minerals they are useless to plants. Again, this very determination of nitrates, which J. P. P. treats so lightly, is so difficult (proportion being so minute) that in a soil analysis it used never to be, and is now hardly ever, attempted. The best chemists find it very difficult to agree about the process which gives the most exact results, while different methods in the same hands, and those the most skilful, give results which often differ by 50 or 100 per cent. An analysis, in short, may be appended as this has been by Mr. Fuller, to confirm the results of field experiments, but by itself it means very little.

Mr. Fuller has committed the mistake in inductive logic of basing a wide generalization upon a very limited breadth of experience. His remarks may be understood to imply that in all Indian soils, and for all crops, nitrogenous manures are the most valuable; whereas, all that may be legitimately inferred from his admirably conducted experiments, is that *on the experimental plots of the Cawnpore farm, in their present condition*, the manure most required *for a wheat crop* is a nitrogenous one—the manure most required for a different crop on the same ground, or for wheat in another part of India, might be a very different one.

G. A. HILL, B. Sc., F.C.S.,
Associate of the Royal School of Mines.

NOTE.—See Editorial Note.—ED., *I. A.*

BOOKS ON AGRICULTURAL CHEMISTRY.

TO THE EDITOR.

SIR,—Besides the books on Agricultural Chemistry, mentioned in your issue of February 1883, I would recommend the following ones to your correspondent, Baboo Rasik Behari Biswas:—

- Agricultural Chemistry, by Davis.
- Familiar Letters on Chemistry, by Liebig.
- Soil, Manure, and Plant, by Schrottkey.
- Soils and Manures, by John Donaldson.
- Chemistry of Agriculture, by Arthur Henry.
- Liebig's Letters on Agriculture.
- Agricultural Chemistry, by Bousingault.

J. N. B.

Choeadanga, E. B. Railway, 4th February 1883.

CASTOR-OIL SEED.

TO THE EDITOR.

SIR,—Can you or any of your readers kindly inform me where I could get a small or large quantity of really good and productive castor-oil tree seed? I shall be glad to pay for the same. I would also be glad to know where good silkworm-eggs and mulberry cuttings could be got.

CULTIVATOR.

Moolydhar, T. G., 30th January, 1883.

JUTE.

TO THE EDITOR.

SIR,—As a contributor to the *Farmers' Review* on flax culture and free trade questions connected with the fibre industry in the Western States of the Union, I herewith take the liberty of requesting you will kindly procure and send me the cost of production and preparation of jute, including all expenses until placed on board-ship.

For some years back attempts have been made in the Gulf and Southern States, Mississippi, Louisiana, Florida and others, to cultivate jute, which appears to be perfectly well adapted to the soil and climate of those States. It is asserted, however, by the protectionists of this country, that the cultivation of jute can only be made remunerative to the American planter, if the native production is "protected" by a high duty, on account of the so-called pauper labour in India, which they assert is, according to their various statements, 20, 15, and even 10 cents a day. In order, therefore, to enable me to judge in how far those statements are correct, and their claim for a high protective duty justified, you would greatly oblige me by sending me a *detailed* statement of the *cost of cultivation* of say 50 or 100 acres of jute, so that a correct comparison may be made with what it costs in this country to produce jute. It would of course be interesting to know also what is the price of the seed, and the quantity sown per acre, the cost of rotting, breaking, &c., also the quantity produced per acre: in fact, all the details necessary in order to go to the root of the matter.

H. KOELKENBECK.

Chicago, 15th December 1882.

NOTE.—Perhaps some of our readers may be kind enough to favour us with the details asked for by our correspondent.—ED., *I. A.*

The Indian Agriculturist.

CALCUTTA, MARCH 1, 1883.

FOREST ADMINISTRATION IN THE PUNJAB.

THE report on Forest Administration in the Punjab for the year 1881-82 shows that a good deal of useful work was done during that period. The changes in the area under the management of the Forest Department, which took place during the year under report, were as follows:—

	Square Miles.			
	Reserved Forests.	Protected Forests.	Unreserved Forests.	Total.
Area on the 1st April 1881 ...	943	311	3,560	4,814
Excluded during the year ...	...	...	238	238
Added during the year ...	217	...	1	218
Area on the 31st March 1882 ...	1,160	311	3,799	5,270

The addition of 217 square miles to the area under reserved forests occurred in the Jhelum and Mooltan divisions, with the exception of 9 square miles in the Chumba

division. The classification of the reserves, as it stood at the end of the year, was as follows :—

	Square Miles.
Upper Hill Forests (deodar, &c.) ...	... 545
Lower Hill Forests (chil, &c.) ...	... 110
Plains Forests, *rakhs* (sanatha, jhand, &c.)	... 505
Total	... 1,160

There has been no change in the area under protected forests during the year under notice ; but we observe that it is [illegible]sed to declare the Kulu forests and the Lahore *rakhs* as protected areas. The 311 square miles which are at present declared "Protected Forests" are—

	Square Miles.
The Kala Chitta, in Rawul Pindee, area	... 171
The Gujranwala *rakhs* ,,	... 140

The local Government notices with satisfaction that there has been a considerable decrease during the year of prosecutions for breaches of the forest rules. The number of cases for trial amounted to 846 ; of these, 136 cases belonged to the year preceding, so that the new prosecutions for the year 1881-82 were 710. Of the total of 846 cases to be disposed of, 716 were concluded during the year, 515 of which resulted in convictions, and 201 in acquittals. The prosecutions were chiefly on account of the following offences :—injury to forests by fire, unauthorised felling, or appropriation of wood, or minor produce, and grazing without permission. There were 92 fires reported in the forests under the control of the department ; the area burnt was 15,633 acres, against 142,599 acres in 1879-80, and 22,073 acres in 1880-81.

As regards cultural operations, the following were the most important of the year :—

Sowing of 20 acres at Sathu with chil (*pinus longifolia*).

Re-sowing of 200 acres in the public reserve.

Planting of 6,425 deodar seedlings at Kalatop on the Ravi side (Chumba division).

Sowing and planting out of 90 acres in Kulu with deodar.

Sowing of 206 acres in Bashahr with deodar.

These operations are all reported as having been successful. The experiments in the cultivation of European and foreign trees have given satisfactory results. Spanish chestnuts at Kilba and Nachan ; cork, oaks, and olive trees in Kulu; limes, maples, elms, larches, the Lombardy poplar, Tasmanian blue gum in Kulu—are all reported to be doing well.

The timber operations of those departments during the year under report were conducted on a larger scale than in the year preceding, as will be seen from the following figures :—

	1880-81. Cubic feet.	1881-82. Cubic feet.	Increase. Cubic feet.
Timbers received during the year	496,676	543,405	46,729
Timber sold during the year ...	476,208	578,940	102,732

The quantity of timber imported into British territory, compared with the results of the previous year, is as follows :—

	1880-81. No.	1881-82. No.
Deodar logs	46,946	20,434
Pine logs	7,336	2,955
Sleepers	270,021	307,929

The deodar logs were all imported from Cashmere, and by far the greater portion of the pine logs were also obtained from Cashmere. The 307,929 sleepers were imported from Cashmere, Mandi, Kapurthulla, and other native states.

The balance of timber in the depôts at the close of the year consisted of 24,986 logs and pieces, containing 110,034 cubic feet. We see that the scarcity of firewood at Rawul Pindee has been brought to an end by the opening of the railway, which tapped the fuel supply of Attock, and the sales from the Government depôt have thereby fallen below those of the preceding year by 50,000 maunds. The Punjab Government considers this satisfactory, inasmuch as the resources of the *rakhs* in the neighbourhood of Rawul Pindee were in some danger of exhaustion under the pressure of great demand. It is also stated that there was a large falling off also in the amount of fire-wood removed by purchasers in the Mooltan *rakhs*, as the railway contractors were able to arrange with private persons for the supply of fuel on favorable terms.

We see that the financial results of the working of the Department are considered to have been satisfactory. The revenue realised was Rs. 16,629 more than in 1880-81, but as the expenditure increased by Rs. 20,902, the net income was Rs. 4,273 less than in the previous year, and amounted to Rs. 1,32,038.

We observe that, in accordance with the wishes of the Government of India, an experiment is being tried in utilising the services of well-recommended non-commissioned officers of the native army, and during the year two men were appointed to the subordinate staff of the Forest Department, and a third is about to be offered the appointment of forester in the Department.

THE COTTON CROP IN THE MADRAS PRESIDENCY.

FROM the report on the cultivation of and trade in cotton in the Madras presidency for the year 1881-82 (Fusli 1291), it appears that the season was generally more favorable than in the preceding year in most of the districts in which cotton is extensively grown.

The area under cotton cultivation during the year amounted to 1,653,595 acres, against 1,508,226 in 1880-81, or an increase of 145,369 acres over the area of the year preceding. The increase took place chiefly in Bellary and Tinnevelly, and to some extent, also, in Cuddapah and Coimbatore. From a comparison of the figures for the last six years, we observe that since 1877-78—the year of the Madras famine—the cultivation of cotton has been steadily increasing, and that the area now reached stands on a level with that of the year immediately preceding the famine, when it amounted to 1,645,389 acres.

The cotton grown was of the indigenous kind, of which there are two species in the presidency, called the white and the red from the color of the flowers. One is a six-months' crop, and the other twelve months. We observe that the acclimatised Bourbon cotton was cultivated in Coimbatore on an area covering 64,731 acres or a little over one-fourth of the total extent under cotton in the district, and yielded 28,898 cwts. of cleaned cotton, or about 50lb. per acre against 26lb., the estimated yield of the indigenous species. Experiments were also made in the Bellary district during the year with Hingunghat, Dhollera, Broach and Bourbon seeds. Broach and Dhollera proved a success, but the results of the attempts made with the Hingunghat and Bourbon seeds is not given.

The total outturn of cleaned cotton during the year amounted to 493,643 cwts., valued at Rs. 1,05,76,044, as against 431,071 cwts., valued at Rs. 97,29,575, in the year preceding. The average yield per acre ranges from 19lb. in Anantapore to 54lb. in Vizagapatam. For the whole presidency the average yield was 37lb. per district, against 36lb. in 1880-81. The largest outturns of cotton were obtained in the Tinnevelly, Kistna, Coimbatore, Kurnool, Madura, Cuddapah, Bellary, and Anantapore districts.

The cost of cultivation per acre varied from Rs. 2-14-0 in Kurnool to Rs. 11-14-11 in Vizagapatam. Comparing the cost of cultivation per acre with the value of the average yield per acre of cleaned cotton, calculated at annas 3-6 per lb, it would appear that in several districts the cultivators must have lost heavily. The districts in which the average cost per acre exceeded the value of the average yield per acre are as follow :—

District.	Average cost per acre. R.	A.	P.	Value of average yield per acre at 3½ annas per lb. R.	A.	P.
South Arcot ...	10	9	1	5	11	0
Coimbatore ...	11	11	0	7	7	0
Madura ...	9	15	8	8	15	6
Salem ...	10	14	0	10	8	0
Tanjore ...	10	7	9	9	10	0
Tinnevelly ...	9	7	10	7	10	6
Trichinopoly ...	9	7	9	5	4	0

The Madras Board of Revenue, however, do not appear to place much trust in these figures, and again impress upon collectors the necessity of testing the accuracy of the information furnished by tehsildars. The several items

which make up the cost of cultivation in each district are—(1) value of seed, (2) cost of ploughing, (3) cost of fencing, (4) manure, (5) cost of sowing, (6) cost of weeding, (7) hire for gathering, (8) assessment per acre. The cost of ploughing appears to have been the heaviest item in several of the districts, and ranged from Re. 1-1-0 in Vizagapatam to Rs. 4-12-8 in Tanjore, though in the latter it included also the cost of fencing.

The average retail prices of cotton retained for local consumption during the year varied from Rs. 85 per candy of 500lb. in Madura, to Rs. 130 in Salem. Compared with 1880-81 the prices obtained were on the whole more favorable.

The total quantity of raw cotton exported from the presidency during the year under report was 459,351 cwts., against 509,889 cwts. in 1879-80, and 365,887 in 1880-81. Compared with the past year, therefore, the exports show an increase of 96,464 cwts., and this is said to be chiefly due to heavy shipments made to the United Kingdom from Tuticorin and Madras during the months of April and June 1882, owing to the very active demand that prevailed in the English market at this time and to the rise in the price of the articles. Of the total exports of the year, 422,346 cwts. was taken by foreign countries, the largest shipments being to the United Kingdom, Italy, France, Austria and Spain; of the balance, 27,894 cwts. went to Bombay, and 9,111 cwts. was exported to Bengal. The total value of the exports was Rs. 1,11,61,394, as against Rs. 92,19,371 in 1880-81.

It would appear that the condition of the weaving classes in the presidency has been gradually deteriorating from the combined effects of the famine and increased importation of English piece-goods. During the year under report the total number of weavers is stated to have been 315,818, against 307,702 in the year preceding. Although in a few localities cloths of very superior quality are still made, which are purchased chiefly by the richer classes in preference to English piece-goods on account of their great durability, the manufacture is stated to be now principally confined to inferior cloths, country twist being used for the coarser kinds, and English twist for the better sorts.

The three cotton mills in the presidency—the Southern India Spinning and Weaving Company, the Madras United Spinning and Weaving Company, and the Buckingham Mills Company—are stated to have continued working throughout the year. The quantity of cotton taken by them was 59,818 cwts., which was chiefly obtained from the Coimbatore, Trichinopoly, Cuddapah, and Bellary districts, at prices varying from 3 annas to 3 annas 7 pies per lb. The Southern India and the Madras United turn out only twists, and the Buckingham Mills produce only yarns.

THE COLONIZATION OF THE TAVOY.

IT has been urged, from different points of view, that the requirement of the times, in an acknowledged period of agricultural depression, is the establishment of agricultural banks by private enterprise for money advances to the peasantry; and in these columns necessity for an improved condition in the ryots' relations with the zemindar has been treated of lengthily. But the circumstances of the European planting community afford equal occasion for anxious consideration. Whatever the divergence in the commercial aspects of the two great industries in India proper, *i.e.*, of tea and indigo, it is certain that the price paid by the consumer of the first is extravagantly out of proportion to the profits derived by the producer, and it is questionable whether the remedy for this is only to be contrived by an extended sale in new markets; and, with regard to the latter, the greatly increased cost of manufacture within the last few years, and the difficulties concerned with the land and rates for labour, largely take from the remunerative return of indigo; while it may be roundly asserted that both industries have the common misfortune of being overcrowded. Every indigo concern has an excess of European employés, and the excess in the tea gardens noticeably leavens the number of unemployed men who are to be found in the streets of Calcutta. These men are distinctively a class without the reproach of improvidence, for their portion has been cast in poorly salaried appointments, and the too ready surmise of intemperate habits is an undeserved libel on the majority. Every ounce of tea, every cake of indigo finds disposal in the market, and the question whether the tea-planter cannot participate to a greater degree in the high prices paid by the consumer will demand attention as the opening up of new markets is effected, the result of which will be to maintain the high retail prices without appreciable gain to the producer. But though, of course, the intermediary agency is the occasion of this, that agency is the backbone of the planter; it provides working advances, TQhs in bad seasons, and is concerned with the entire realization. It is not therefore that in this generalisation of the circumstances of tea enterprize any aspersion is levelled at the agencies which, in the eminent firms of Messrs. Moran and Thomas, find distinguished repute. It is the general want of independent capital which characterizes the enterprise that has to make a return on borrowed money. This must continue until the concerns grow wealthy by economic management, good seasons, and large sales. But the unemployed excess of planters,—what is to be done by them? Emigrate. Where to? With what means? That pioneer spirit of enterprise which has built up the vast fabric of the Indian Empire has made no response to the invitation of the Government of British Burmah, to colonise the district of Tavoy. That Government has proffered rent-free grants of land on the most liberal terms. The country itself is primeval forest and virgin soil, with a mountain range of 6,000 feet altitude. The climate is pleasant, and the two hottest months of the year, February and March, are cooled by the sea breezes. It has been described by Dr. Helfer, an American missionary, in 1838, as an Eden of fertility, and the "Imperial Gazetteer of India" gives an authoritative corroboration of its untried capabilities. Sparsity of inhabitants has presented a labour difficulty; but this may be said to have existed in the past, and the present time affords the opportunity of attracting Chinese labour with peculiar facility. Shut out from America and Australia, Chinese emigrants are making their way to North Borneo. The Cingalese incursion into Queensland has proved abortive. There are masses of labourers to be had when the stream is once directed. But the requirement is capital. Planters out at elbow may proffer their services, in preference to attempting the Colonies; and such as have an insignificant trifle may well hesitate before embarking their little all in a venture to Tavoy, where the first reverse would prove ruin. But the avidity with which shares in the North Borneo Company have been taken up shows that the dubious nature of foreign investments has led the public to seize upon any other outlet for speculation that gives fairer promise. Money cannot be tied up, and English capital may be as confidently directed to the colonisation of Tavoy as to possibilities in North Borneo. A project is, we understand, under the consideration of Mr. Hudson, the Secretary of the Behar Planters' Association, which has not yet proceeded beyond a preliminary enquiry, as to its general merits, and the Government of British Burmah favours the formation of a company, which would have for its objects the acquisition of the entire available land, and planting operations on a large scale. Here is a scheme which, if practicable, should receive, and there is no doubt will receive, the encouragement of the Government of India. Not less politically, than commercially, will advantage be derived from the opening out of a tract which is the high road to Bangkok and Siam.

MR. BRANDIS' SUGGESTIONS REGARDING FOREST ADMINISTRATION IN MADRAS.

IT is scarcely possible within the limits of a single article to do anything like justice to the very full and able "Suggestions regarding Forest Administration in the Madras Presidency," by Mr. D. Brandis, F.R.S., C.I.E., the Inspector-General of Forests to the Government of India. We have no hesitation in stating that Mr. Brandis' "Suggestions," as he modestly calls them, form the most complete report on Indian Forestry that has, up to the present, been issued by the Government Press of any Presidency. The work consists of 337

pages folio, and deals with the whole subject of forest administration in such an exhaustive fashion, that it will probably for many years to come remain the highest authority on the subject with which it deals. Mr. Brandis is, after a long career in India, about to retire from the service, so that the present volume may be regarded as the last official contribution to Indian Forestry he is likely to make. The opinions of an officer of such wide and varied experience and attainments with them a weight of authority which is on the whole likely to shape, for some considerable time at least, the policy of the great department over which he so ably presided. A work of this nature, so varied in its contents, so multitudinous in detail, so carefully thought out in all its parts, and so fruitful in suggestions, is not easily dealt with when any attempt is made to present in anything like adequate detail the topics with which it deals. Mr. Brandis' "Suggestions" are full of material from which not only forest officers and the official classes generally may gather useful information and suggestions, but the wealth of subsidiary collateral topics dealt with are such, that nearly every educated man in India may read with pleasure and profit what Mr. Brandis modestly says, was mainly "intended to be read by the forest officers employed in the districts to which the remarks relate."

All we shall on the present occasion venture to do, is to present to our readers some of Mr. Brandis' conclusions, reserving for a future occasion a more detailed examination of the "Suggestions." With regard to the supply of railway fuel, he says that—

"The railway should be encouraged to draw as much wood as possible from private forests; the supplies from this source in the inland districts will probably diminish, and as they diminish, the requirements must be met to a greater extent from the Government forests. In order to make my meaning clear, I have, in the preceding paragraphs, put forward some figures, which may be summarised as follows :—

	Private.	Government.	Total.
	Tons.	Tons.	Tons.
Supply in 1881	55,760	12,660	68,420
Future supply	39,000	42,000	81,000

"Should the efforts fail, which must be made to induce private landholders to preserve and plant with the view of supplying the railway, the supplies from private sources would probably diminish further; but as they decrease, the condition of the Government forests will improve, and consequently their productive powers will increase. This relates to the inland districts. On the east coast the private casuariana plantations are so extensive, chiefly in Chingleput, that the price of this wood must fall, and it may eventually pay the Madras Railway to burn it.

"Should the extensions here suggested be found to be insufficient to supply the requirements of the railway, the further experience which will then have been gained will doubtless show the way to the measures required to meet the case. The Kurnool-Cuddapah canal is navigable from August to January and the question should be studied in detail, whether wood from the Nallamais in Kurnool and the Lankamalais in Cuddapah can be brought down the canal to Krishnapuram on the railway at remunerative rates. The floating of wood down the Cauvery has been tried and been found to fail, but plantations near the line in the vicinity of the Cauvery or other rivers might be made; the former reserves near Mettapollium might be re-established, or suitable tracts on the Nilgiri slopes, near the Mettapollium terminus, might be placed under strict protection. If a railway is constructed to Ootacamund, the plantations of Australian *eucalyptus* and *acacia* on the plateau should be extended largely and might furnish a large supply. So much has been established by the researches recently made by Mr. Hutchins, that these plantations can be made to furnish a mean annual yield of 6 tons per acre, good and bad included. Under these circumstances, it is not at all impossible that, if these plantations can be made and maintained at a responsible outlay, and if the needful land can be obtained, the blue gum grown on the Nilgiris may some day contribute to the fuel-supply of the Madras Railway. If suitable land can be made available on the plateau of the Shevaroys, an experimental plantation of Australian trees should be made. *Acacia aslanoxylon* as well as some species of *eucalyptus* seem to thrive at Yercaud. At present it would be premature to enter further into these schemes. It will be time enough to consider them when necessity arises for doing so. It has been recommended to encourage the use of coal in the place of wood on the Madras Railway, in order to guard against the destruction of the forests. Such recommendations are not based upon a correct appreciation of the case. In the interests of forest conservancy, it is most desirable to encourage the consumption of wood by the railway. Forests are useful in many ways, besides producing a supply of wood and timber. But forests cannot be maintained without some return of revenue from them. Thus, if the Madras Railway finds it profitable to burn wood in preference to coal, this will cause an increased demand for wood, which will enable Government to maintain, under efficient protection, a larger area of State forests than would be possible if the produce could not be sold.

"In the preceding remarks I have not adverted to Indian coal as a possible rival of wood-fuel. It is not impossible that when the system of coast canals has been completed from the Hooghly to Madras, or perhaps even sooner, Bengal coal may compete at Madras with English and Australian coal. And when the coal-fields in the Nizam's territory have been connected by tramway with Bezvada on the Kistna river, it is probable that Singareni coal may be delivered at less cost at Madras than sea-borne coal. But considering the quality of the Singareni coal, and the large quantity of ash which it contains, it seems doubtful whether, under existing circumstances, it can be landed at Madras at rates sufficiently low to enable the railways to dispense with wood-fuel in the inland districts of the Presidency."

The wealth of the Madras Presidency in workable iron ores is well-known, and there still exists at all events the remains of the old iron industry of the province. Unlike Bengal, Madras has no coal, so that the future of iron smelting in Madras is entirely a forest question. The cost of sea-borne coal, it seems, ranges from Rs. 16 to Rs. 18 a ton at the eastern ports, and is consequently prohibitive; nor does it seem likely that Indian coal from Bengal, the Nizam's dominions, or Central India could be delivered at rates sufficiently low as would make it available for iron-smelting in inland districts. It is, therefore, to the forests of the Presidency that Government must look for whatever local iron industries it may be possible to build up, and foster. On this point Mr. Brandis says :—

"Under proper management, the extension of iron-smelting in the Madras Presidency will in no way increase the denudation of the country. On the contrary it will facilitate the formation, protection, and improvement of the forests.

"In most forests the more valuable species, the timber or other produce of which finds a ready sale even when brought from remote localities, is associated with a large proportion of the less valuable kinds, for the produce of which there is no demand in such places. The less valuable species profit equally with and in some cases more than the valuable kinds, by efficient protection, and particularly by protection against fire. In fire-protected blocks, the forest becomes dense and thick, the grassy glades and other blank spaces fill up rapidly, but a large proportion of the material which grows up in so satisfactory a manner cannot be utilized. On the contrary, its existence in the forest prevents the free production of the more valuable kind, which therefore cannot be cut as freely as would otherwise be desirable. The abundance of inferior classes of wood will, therefore, be felt as a burden and a source of difficulty hereafter, when a rational plan of working is set on foot. The native iron-smelters give preference to certain kinds of wood, such as *acacia catechu* and *albizzia amara*, but the charcoal of most species, both of the deciduous and the evergreen forests,

can be utilized for iron-smelting. I may here mention that Colonel Keatinge, when Political Agent of Nimar, before 1857, found that the light and soft wood of *boswellia thurifera* (saler) made excellent charcoal for iron-smelting in the works established by him in Nimar, and successfully worked during a series of years with the aid of a Swedish iron-master.

"The extension of iron-making by means of charcoal will be a great help towards the development of rational forest management in the Madras Presidency. But the native methods of iron-smelting with charcoal are exceedingly wasteful, and an attempt should therefore be made to introduce an improved method. It is at present generally supposed that the direct system of producing wrought iron from the ore is not capable of considerable improvement. This is a point upon which I am not competent to form any definite opinion. I know, however, that some persons in England competent to speak on the subject hold that the direct process is capable of considerable improvement, and that iron-smelting by means of charcoal in India has a great future before it.

"Moreover, it may not be impossible to carry out a suggestion made some time ago by Dr. H Warth, Professor of Natural Sciences at the Dehra Doon Forest School, and to construct blast furnaces of a somewhat smaller size than those used in Europe, so that they can be managed by natives. The object would be to teach them the system of making pig-iron first, and converting this by a separate process into finished iron. Such experiments can only be made by Government agency, and I am of opinion that it will be well worth while to attach a competent metallurgist, who has had a practical experience in iron-smelting with charcoal, to the Madras Forest Department for a series of years—first, in order to assist the Forest Officers in the selection of reserves in the iron districts; and afterwards to undertake iron-making in suitable localities on an improved plan, with the view of gradually introducing improvements in the native methods. Efforts should at the same time be made to establish a better and less wasteful system of charcoal burning. The development and improvement of the native iron industry is as much within the scope of the legitimate duties of Government as the attempts made, by the establishment of model farms and otherwise, to improve native agriculture. The experimental operations here suggested must not be expected to yield revenue. If their cost is covered by the sale of the iron produced, that is all that can be hoped for. The object is not revenue, but to show the native iron-smelters the way towards improved and more economical methods, and to pave the way for the establishment of large iron works by private enterprise.

"These suggestions I submit with hesitation, as a late Resolution by the Government of India in the Department of Finance and Commerce, which was published in the *Gazette of India* of the 5th August last, lays it down that the establishment of iron works to be owned and worked by the State is open to grave objections, both economic and practical. That Resolution, however, primarily refers to the Bengal iron works, which are worked with coal, and where, therefore, a private firm or company can base its calculations upon certain data regarding the quantity and cost of the fuel available; and in the second place, it relates to the iron works proposed to be established in the Chanda District, where the greater part of the fuel will be furnished by the Warora coal-mines.

"In the Madras Presidency, the question is much more difficult. The absence of coal and the uncertainty regarding the annual yield of charcoal per acre in the areas which may be constituted reserved forests, make it impossible at present to furnish any safe data upon the ground of which private capital might be invited to embark in this industry on a large scale. This must wait until a sufficient extent of reserved forests have actually been established, and have by continued protection and steady improvement been converted into dense forest."

With regard to the effect on climate of forest protection, Mr. Brandis speaks very decidedly. He has no hope that forest conservancy can either materially alter the climate, or guard against the recurrence of excessive drought. No data, he says, "have been established which would justify the hope that by the creation of new forests or the improvement of those existing, we shall be able to modify the limits of the regions of moisture, or otherwise materially to alter the climate of any district in the Peninsula. The great features of climate depend upon cosmic causes which are independent of local circumstances.

"It has been established by continued experiments made by L. Fautrat in the forests of Halatte and Ermenonville in France that a guage placed above the crowns of the trees in a forest, collects more rain than another placed in its vicinity at the same height from the ground but outside the forest. A brief abstract of these observations will be found recorded in paragraph 56 of my Report on Ajmere and Merwara, page 17. Observations of this kind will, it is hoped, some day be made in the Indian forests. Large extents of forest or large areas of irrigated land may have some effect in increasing the rainfall at certain seasons, and there is no doubt that in the vicinity of dense forests, and on irrigated lands, the air near the ground is generally moister during the dry season and the dew heavier. Nor is there any doubt that forests, if well stocked, afford effective shelter against scorching winds, and that in the hot weather the shade and shelter afforded by trees is a great boon, and is beneficial alike to crops, to man, and to cattle.

"These are, however, advantages which, though exceedingly important, only affect the immediate vicinity of the forest. The idea that forest conservancy can in any way materially alter the climate of the peninsula, or can guard against the recurrence of seasons of excessive drought must, I fear, be put aside, and our plans regarding forest administration in the peninsula must, at present at least, be framed without reference to such expectations."

With regard to the effects of forests in protecting the soil, and regulating surface and sub-soil drainage, the following remarks are made:—

"It is different in regard to the influence of forests in other respects. They protect the soil on slopes and hills, and there is good ground for believing that they regulate the distribution of the rain-water which falls upon the ground, and the surface and underground drainage. In this respect the action of forests is, we believe, most beneficial in a tropical climate. The action is this: *First*, the foliage breaks the force of the rain, which therefore falls upon the ground more gradually and gently; *second*, the loss by evaporation is less; *third*, decayed leaves, moss, twigs, and other matter on the ground in the forest act as a sponge, and prevent the rapid down-flow of the water; *fourth*, the soil which is permeated by the roots and is mixed with vegetable mould, is loose and facilitates the percolation of the water, which comes out at a lower elevation in the shape of springs.

"A further and most important result is, that less soil is washed away from the hill-sides and that less sand and silt are carried down by the rivers. Regarding this point, no doubt is possible. Wherever clearances are made on the hills in those districts of India which have a heavy rainfall, the loose soil is washed down into the streams and rivers, unless retained by terraces, lines of trees, shrubs, or other vegetation. There is not a district in the moister regions of India where the evil effects of denudation in this respect are not visible. The sand which is washed down from the denuded hills in the Hoshiarpore district of the Punjab, has destroyed the fertility of large areas. Ravines and torrents are numerous in the more thickly inhabited portions of the North-West Himalaya and in the Darjeeling district in Bengal. And yet in these districts the climate is so favourable, and vegetation so luxuriant, that hill-sides, which have been cut up by landslips and torrents, if left alone, often re-clothe themselves rapidly with grass, herbs, and other vegetation. Even on the Nilgiris the evil will be felt sooner or later, although these hills are favored beyond any hill range in India by gentle slopes, deep soil, and a moderate rainfall, which is distributed over nine months of the year, and most of which comes down in gentle showers. Every year masses of fine silt, which, if retained, might be a source of wealth to the planter, as well as to the Badaga, are washed down into the Bhavani and Moyar rivers, and unless the slopes are terraced, or coffee, tea, and cinchona are planted close in horizontal contour lines, the annual loss of rich loose soil will eventually make itself felt.

"The Ratnagiri district, in Bombay, is almost bare up to the crest of the ghats. Here the effects of denudation have shown themselves in this way :—There are four principal streams in the district, which, rising in the ghat mountains, run a short course to the sea, all of which were formerly navigable and important for the trade of the country. For small boats they are still navigable, but they are gradually silting up, because the hills on their head-waters have become denuded of forest.

"As regards evaporation, it may be useful to draw attention to the results of the experiment made at six stations in Bavaria, in the forest and in its immediate vicinity outside, which are recorded in the work by E. Ebermayer, entitled 'Die physikalischen Einwirkungen des Waldes auf Luft und Boden, 1873.' On page 159 the author states, as the result of these experiments, that the quantity evaporated in one year (1868-69) from a free surface of water, measuring one square foot (Paris), was as follows :—

In the open 3,180 cubic inches (Paris) } corresponding to a { 598 millimeters deep.
In the forest 1,164 " " } stratum of water { 219 " "

"Ebermayer also states that the mean annual evaporation in the open, at different places, had been found to be as follows :—

	Millimeters.		Millimeters.
Vienna ...	720	Paris	783
Lausanne ...	756	London ...	780
Bar-le-Duc ...	531	Liverpool ...	962
Auxerre ...	557	Manchester ...	780

"The great difference in the results, Ebermayer ascribes to the different construction of the instruments used, and to the different modes of placing them. In London it was found by Halley that, while in a room 208 millimeters evaporated during the year, the evaporation amounted to 1,248 millimeters if the surface of the water was freely exposed to sun and wind. In dry districts of India evaporation is naturally much more rapid than in northern Europe. Thus at Nagpore, the quantity evaporated from the Ambajhari tank during the dry season (8 months) was 7 feet, equal to 135 millimeters; and Mr. Culcheth came to a similar result in regard to evaporation from tanks in Ajmere and Merwara. It may be assumed that in India the effect of forest in diminishing evaporation is much greater than in northern Europe.

"The effect of forest upon the moisture in the soil is however of a most complicated nature. For while on the one hand the evaporation of the rain water is diminished, there is on the other no doubt that, under certain circumstances, trees and forests tend to dry up the soil, the roots drawing up moisture often from great depths, which is evaporated by the leaves. It is a common practice in Europe, to dry up swamps and wet places by planting fast-growing trees. Mr. D. E. Hutchins, Deputy Conservator of Forests, Mysore, informs me that the effect of plantations of casuarina and other trees, so successfully made at Bangalore and elsewhere on the Mysore plateau, has been, in some cases, to diminish the water-supply in wells in these plantations and in the station of Bangalore. His views on this subject will be found set forth in a paper regarding the influence of forests on moisture, appended to this report. (Appendix VI.)

"It will now be well to examine the probable effect of forests upon the water-supply in tanks, streams, springs, and wells.

"Speaking broadly, the result as regards the supply of springs, streams and rivers is believed to be this, that springs are better supplied and that streams and rivers are less subject to sudden floods, and have a more even and longer continued flow of water if their catchment area is stocked with forest than if it is bare. The effect is the same upon tanks which are fed from springs and streams. But upon tanks with a small catchment area, which are fed only by the surface drainage coming direct from that area, the effect is different. Tanks of that description would store the largest proportion possible of the water coming from the catchment area if that area were smoothed and plastered over, and made impermeable to the rain which falls upon it. In such cases a hard-baked surface of the catchment area, without any vegetation, would be most effective."

EDITORIAL NOTES.

A RESOLUTION published in the *Calcutta Gazette* deals with the proposed establishment of a Veterinary School in Bengal. Reports of severe outbreaks of cattle-disease have, from time to time, for many years past, reached the Bengal Government, and the need of a trained agency for the treatment of cattle is greatly felt. The establishment of a school for the special object of imparting instruction in veterinary science, and the training of a class of natives for service among the people, has long been under consideration. His Honor the Lieutenant-Governor is now of opinion that, as the efforts made in past years to convey instruction to the people in these matters have been attended with no lasting success, the question of opening a Veterinary School in Calcutta should at once be definitely taken up by the Government, and he has decided to refer it to a committee of gentlemen specially qualified to report upon the scheme. Of this committee, Surgeon-Major K. McLeod, M.D., has been appointed president, and Inspecting Veterinary Surgeon J. H. B. Hallen and Dr. T. Greenhill, members. This committee will report on the cost of such an institution, the staff to be employed, the best site for the school, and the instruction to be given. The report is called for before the end of the present cold season.

IN Messrs. Stenning, Inskipp and Co's Indian tea market review for 1882, the following advice is given to Indian tea-planters :—

Last year at this time we warned producers against coarse plucking and the results which would follow : we venture to point out that our anticipation of low prices is unhappily confirmed, for notwithstanding the good enquiry that has existed all the season for teas for price, values for common and medium are now positively at the lowest point ever touched, and good medium to fine are selling several pence below their intrinsic value. In 1881 fine picking was carried too far, and this season coarse plucking has been too much in vogue. It seems to us that the only safe plan is to pick moderately fine throughout, and without sorting too fine generally, to make moderate proportion of fine pekoe and broken pekoe, more particularly the latter, to sell here at, say, from 1/10 to 2/4 ; this would prevent a superabundance of medium kinds, and the depreciation in value which naturally follows.

Bulking.—The progress of this in India is slow, owing probably to difficulties attendant on want of room at the factory, and also to the danger of climate, but on several estates these difficulties appear to have been surmounted, and the teas turn out very satisfactorily ; it is evident that the condition of the tea should be better by not having to be turned out of the chest here, and exposed on the warehouse floor to the atmosphere, and afterwards trodden back into the packages : such treatment is a risk to the appearance of the leaf and to the flavour of the tea. Besides these disadvantages, the packages themselves with their lead linings are in a better condition than when they have to be opened and afterwards closed up : and there is also less delay in bringing to auction and in delivering to buyers. If tares run evenly in a break of Indian bulked teas, or are within 5lbs. of each other, a certain proportion, *viz.*, one-sixth to one-tenth, is turned out to obtain an average tare. The advantages of bulking in India *where it can be properly done*, are very manifest.

THE following letter from Mr. W. R. Robertson, M.R.A.C., Agricultural Reporter to the Government of Madras, was recently sent to Government :—"With reference to G.O., No. 1238, of the 11th instant, I have the honor to enclose two samples of Nankin cotton produced on the Saidapet Farm, Sample No. 1—in the seed ; sample No. 2—clean lint. It will be observed that there are several shades of color in the unginned sample, and that these differences disappear to a considerable extent when the cotton is ginned, due to the thorough admixture of the fibre in the process of ginning ; and during the spinning and weaving processes, I think a still greater uniformity in color will be secured. The Nankin cotton has been grown in this presidency as a botanical

curiosity for fifty years or more. It was originally imported from China, where the fabrics made from this cotton are in great demand for their cheapness and great durability. At one time, large quantities of Nankin cloth were exported from China, but I understand that its export has now almost ceased. I do not think the crop is grown anywhere in the Presidency, except on a very small scale. I remember seeing its growing at the Coimbatore Jail Farm about ten years ago; but Mr. Grimes, who, I observe, has been addressed, will probably submit the results of his experience there. I am now putting an acre of land under the crop, and this should in four or five months give enough seed for 20 or 25 acres of land which will probably suffice for experimental trials."

Mr. H. R. Grimes, Superintendent, Central Jail, Coimbatore, also wrote on the same subject as follow:—

"In reply to the Order of Government, dated 11th November 1882, No. 1238, Revenue, I have the honor to report that I have grown Nankin cotton on the Jail grounds since the year 1868, in which year two seeds were given me by the Hon. J. D. Sim, which both germinated; and from those two seeds, I have been enabled to plant at different times about 12 acres of land. It is a hardy description of cotton, grows in any description of soil, is perennial, and gives more than one keeping a year. I regret now I have not kept an account of how many times a year I have picked one field, or what quantity of cotton I obtained at each picking. The plant in the field grows to a height of about eighteen inches, but in favourable localities I have had it grow into a large bush, quite four feet in height. I have the honor to submit for the inspection of Government some of this cotton in the pod, some hanks of thread spun by the convicts from it, and two samples of cloth made from it in the Jail.

"Owing to the recent order of Government putting a stop to miscellaneous jail manufacture, I have just rooted up the last field of this cotton, which was planted in 1879, as I thought there would be no further use in cultivating. I have, however, a small quantity of it in my own garden, from which I can obtain seed and can recommence its cultivation if necessary. I believe it is not cultivated by the ryots in this district, but I am told it is so in the Tinnevelly District. The great drawback to it is its shortness in fibre. I should much like to obtain fresh seed from Chunar or elsewhere, to ascertain whether it is superior to what I have grown. Brigadier-General Clerk, who accompanied his Excellency the Commander-in-Chief in his recent visit to this Jail took twenty yards of this 'Nankin' cloth, with a view of trying its suitability for the summer clothing of troops."

A CORRESPONDENT, writing to the *Ceylon Observer*, says:—Of the several varieties of rubber, the Ceara seems most suited for the Kalutara district, chiefly owing to its rapid and easy growth and its adaptability to *dry soil* though the district is a wet one. Swamps, if deeply drained and raised and above flood level, seem to answer. Of course on any land submerged by annual floods the rubber trees sicken and many die. Of the other varieties, Para, Castilloa, Landolphia, &c., little can be said, as they are of very slow growth, and for this reason it is not advisable for those who look for quick returns to attempt the cultivation of them, even though the soil suitable for them can be found and selected. A period of 12 to 15 years is rather a long time to wait, for it is probable, at the comparative rate they grow, that this period must elapse before the trees can yield a return of any value. The Ceara grows very rapidly in twelve months, and then begins at an average height at ten feet to throw out branches. Trees of even eight months' growth have a few clusters of fruit. At the end of the 3rd year, they attain a height of 13 feet or more with numerous branches spreading out 10 or 12 feet. The trunk has a girth of about 20 inches, a foot above ground. In its second year it commences to bear profusely, so that the price for rubber seed will soon go down. The inner branches are rather numerous and spindly. They ought properly to be thinned out with the object of growing thicker and stout lower branches, that would also, besides the trunk, be fit to be tapped in a few years. Strong winds occasionally play havoc with the branches when the tree is top-heavy. The branches snap off easily, and as they lie on the ground begin in a few days to throw out healthy shoots of a foot in length and before there is a sign of a root, the seed falling from the bursting capsules germ under the trees easily. It has already been pronounced a big weed, the growth of which will have to be checked and regulated in the vicinity of delicate products. The roots spread on and a little above the surface, throwing out carrot-shaped tubers. These are relished by the pigs, but two coolies, it seems, experimenting on them as edibles, were poisoned to death. The rubber thrives best where the soil is rich and penetrable with an alavanga to some depth. It is not therefore advisable to plant out a field of them above a 100 feet or so above the bottom or base of a hill, but along ravines, flats, and gentle slopes, &c.; in fact, wherever there is a fair depth of soil, it can be safely put out. Those plants high up and near ridges have not their leaves of a healthy bluish-green tinge, but have rather pale and sickly leaves and seem small in growth. Once a year after the crop, the rubbers drop their leaves entirely and look very bare, but throw out a fresh flush in three weeks or so. In all probability a tree grown under favourable conditions will not be sufficiently developed and fit till its 4th or 5th year to be operated on. Though the sap can be drawn from a three-year-old tree, the yield cannot be much or of much value, while the lacerating process in drawing the sap will retard its growth and make it a poorer tree at a desirable age. If the milk or juice is dropped into water it coagulates, and the rubber is ready in a few moments. As neither cardamom nor cocoa growing amongst the rubber seems to suffer from the rootlets or fallen leaves, they might answer a double purpose, and be used as shade trees.

THE following is the order of the Madras Government on the Conservator's Report for 1881-82:—The report of the Conservator compares favourably with that of the previous year, and the Board's exhaustive review leaves but little for the Government to remark on. The receipts and charges of the year under report were Rs. 5,06,456 and Rs. 3,89,892, respectively, leaving a surplus of Rs. 1,16,564 as against a surplus of Rs. 1,34,716 in the year 1880-81, and an average surplus of Rs. 4,638 in the five years ending with 1879-80. This result is satisfactory. The Government observe that, while the removal of Rs. 1,83,577 worth of timber by the Department last year was effected at a cost of Rs. 43,100, the removal of timber valued at Rs. 1,35,972 in the year under report cost Rs. 57,014. Similarly, while the removal of sandalwood, valued at Rs. 35,719, cost Rs. 9,851 in 1881-82, it cost only Rs. 8,689 in 1880-81 to remove a larger quantity valued at Rs. 38,265. These and other variations of the same character are explained in part by the increase in stock at the end of the year, and the fact that the establishment and up-keep expenses do not vary in proportion to the increase or decrease in sales. The amount expended on timber operations during one single year gives no practically useful result. In his next annual report the Conservator should endeavour to give the quantity of timber brought to depôt for two or three years, and the amount expended thereon. The figures, as they stand, need re-arrangement or explanation. The investigation proposed by the Conservator in paragraph 80 of his report should be of a searching character. It is probable, as suggested, that the disparity evidenced by the statement of apportionment of fixed establishment charges between the results of the departmental and the license and voucher systems is greater than what really exists. The figures should be well scrutinised, and the results noted in the report for 1882-83. The Board's observations on the subject are approved.

Reserved Forests.—The Conservator submits a statement, compiled from detailed information, carefully collected for the Inspector-General, exhibiting the extent of the reserves hitherto officially recognized as such. The estimated area, excluding those tracts for the reservation of which no authoritative sanction can be traced, is given at 1,182 square miles. The areas for each district will, as the work of selection proceeds, and as the tracts are formally taken up under the Act, be subject to modification. In this connection Major Walker reports on the operations of Mr. Cherry, the officer entrusted with the duty of selecting reserves in the Salem district during the year under review. The result is that the Committee have agreed in selecting 35 reserves conveniently distributed and containing 306 square miles, which is accepted as satisfactory. The people concerned have been served with notices of the intended reservations and their claims are being recorded. These will hereafter

have to be investigated and disposed of in accordance with the procedure laid down in the Forest Act. With reference to paragraph 10, orders have been passed on the Ganjam reserves. As observed by the Board of Revenue, orders on the reserves mentioned in paragraphs 14 and 15 must await action under the Forest Act. Adverting to paragraph 19, the Conservator should, in communication with the Revenue authorities, take steps for extending the area of sandalwood reserves in the Coimbatore district. The receipts from fuel reserves were Rs. 23,504, or Rs. 5,245 in excess of those of last year :—

			Acres.
Total area reserved		.	... 160,259
Equal to fully stocked		.	... 60,475
			Rs.
Receipts...	in the year	.	... 23,504
	up to year	.	... 76,383
Charges...	in the year	.	... 6,849
	up to last year.	.	...1,64,947

The Conservator should report on what data the elaborate and detailed statement of fuel reserves is based, and how far Government are justified in accepting it as accurate. The Conservator will pay particular attention to the remarks made by the Board in paragraph 9 of their Proceedings. Paragraph 87 of the report will be referred to the Public Works Department for report as to the delay which has occurred in utilizing the allotment made for Forest Officer's quarters in Kurnool. The interesting details furnished by Mr. Ferguson in his report show that the mahogany and India-rubber trees are on the whole doing well. The Conservator will adopt the Board's suggestion in view to the identification of the insect which has attacked the mahogany trees. It is not stated in the report whether any further experiments have been made for testing the tanning properties of wattle-bark. The Conservator's *resumé* of the work, accomplished by the Department since its organization in 1856, has been perused with interest.

On given amounts of food, the sheep produces, for the same weight of dry food, nearly twice as much manure as the pig, while the ox produces even more than the sheep. This difference is supposed to be due to the less digestible character of the food supplied to the sheep and ox. The quantity of manure produced during the same time, and for the same body weight is, however, very similar with the three animals, the greater consumption of food by the pig counterbalancing its lower rate of manure production.

The business of growing pine-apples in the Bahamas is in some years very profitable, and in others the reverse. An acre of good land will carry 6,000 plants of the sugar-loaf variety or about 5,000 of the scarlet kind. The price of land runs from £4 to £5 an acre, and if a site can be obtained on the bay so that the fruit can be easily shipped, the business of growing yields excellent results. The total export for the season is from four to five million pine-apples. The average price paid is about 1*s.* 9*d.* per dozen for the first cutting (the first year's produce), 1*s.* 6*d.* for seconds, and 1*s.* 3*d.* for thirds. As a rule, the scarlets go to the United States, the sugar-loafs to England. The wages paid are about 2*s.* per day for men, 1*s.* for women, and 6*d.* for children. Of late, the business of putting up the fruit preserved in tins has been commenced, and it has already attained considerable proportions. In 1880 about 200,000 tins were exported, and in 1881, the number was increased to 287,000 tins. Bad weather for several years in succession interfered with the success of the crops, but since 1880 the seasons have been favourable.

The possibility of raising rust-proof varieties of wheat has been discussed without any practical outcome for an indefinite length of time. The author of the idea is unknown, but attempts to carry it out will doubtless continue to be made *ad infinitum*. We notice that Mr. William Farrer, of Warren, New South Wales, seeing that rust has again appeared in the Darling Downs, has written to the *Queenslander*, urging that further attempts be made in the way indicated. He says :— "I notice that the rust has again made its appearance in the wheat crops of the Darling Downs, and that the cultivation of Indian varieties of wheat has failed to secure the immunity from rust that was hoped from it. I trust that no one will be led by this failure to doubt that wheat-growing can yet be established as one of the grand industries of Queensland ; but it will not be established until a variety of wheat has been secured that is suited to the condition of your climate. I beg to submit the following suggestions in regard to securing such a variety. I will first of all point out the probability that a strong analogy exists between the rust of the wheat and the American blight of the apple. Careful selection has been brought to bear on the apple, and has resulted in the securing of a large number of varieties that are either blight-proof or so little liable to the blight as to be exceedingly valuable. Until similar careful selection is brought to bear on the wheat, I believe that little headway will be made with wheat-growing in Queensland. A rust-resisting variety may be secured by a happy fluke, but I do not think you ought to rely on the chance of that. The process that ought to be gone through I believe to be substantially as follows :—1. Let farmers who have rusty crops this year go through them carefully, and see if they can discover any heads that are free from rust. Such heads should be carefully watched, and plucked when ripe, and sent to the National Association or to some private person who would interest himself in this matter. 2.—Some of these sound heads would, in all probability, produce grain with rust-resisting properties. I would suggest that the grain from these heads be mixed, and sown under conditions that would invite the occurrence of rust, and that the sound heads from the resulting crop be again selected and saved. If this process be repeated a sufficient number of times, I think it more than likely that a number of rust-proof varieties will be secured ; but they will have been chosen for ability to resist rust alone. 3.—The next process will be the selection from the rust-proof varieties of sorts that are also valuable for their milling properties. I expect that at this stage much might be gained by artificially crossing the different rust-proof varieties." Mr. Farrer is hardly justified in assuming that a strong analogy exists between the two cases cited. Analysis of certain varieties of apple—blighting and non-blighting kinds—disclosed the fact that the latter contained lime in considerable proportion, whilst from the former lime was almost absent. Applications of lime to the roots and branches had long been a recognised cure for the blight, and thus the analysis explained the cause of the immunity of such varieties as Winter Majetin and Northern Spy from the attacks of aphis. In the case of wheats the rust is a fungus, and rust-proof wheats have hitherto been found only amongst varieties having very hard straw, with grain that is better adapted for making macaroni than flour. Experience, so far, has shown that when the composition of the grain is changed in the desired direction, the straw loses its rust-resisting power. We do not wish to discourage intending experimenters ; indeed, we shall be rather helping them by pointing out the obstacles which appear to beset their path.

The Paris correspondent of the *Madras Mail* says :—"Ammonia and nitrates play so important a *rôle* in vegetation and cultivated soils, that too much importance cannot be given to clearly indicate what is exactly known, and what is uncertain. The Pic du Midi in France is a meteorological station, 3,164 feet above the level of the sea. Messrs. Muntz and Aubin have analysed the ammonia contained in the air at that altitude, but found no perceptible difference as compared with that contained in the air at the level of the sea and in the low lands. Water collected at the same height from rain, snow, and 'fog' contained less ammonia than that contained in the vicinity of London and Paris. In other words, the strata of air nearest the ground are richer in ammonia, due to the drops of water sweeping through a longer extent of air. It is to Boussingault reverts the honor of demonstrating the permanency of ammonia in fogs and dew. That permanency has not been proven in the case of rain-water. One fact admits of no question—that the quantity of ammonia in the air is variable. Schlœsing emits the opinion that ocean is the great reservoir of ammonia. This is not wholly exact, as certain electric influences can produce ammonia in the atmosphere. Messrs. Muntz and Aubin did

not discover any nitrates in the air. Such do not, as a rule, there exist. Nitrates are only produced in the atmosphere, following electric discharges, hence, why nitrates are always present in meteoric rain-water. The formation and the decomposition of nitrates by opposite causes, have been demonstrated in the case of drained lands by Berrul and Kuhlmann. A new explanatory fact has been made known, that one class of animalcules makes the nitrification, while another destroys the combination of the elements. The process of nitrification takes place, according to the experiments of Messrs. Deherain and Maquenne, only in soils rich in organic matter, and exempt from the action of oxygen. These conditions can only be fulfilled in the case of bog lands or flooded soils. One fact worthy of notice, the decomposition of the nitrates, or reduction to their original elements, is accompanied by the production of prot-oxyde of nitrogen, commonly known as laughing-gas, and employed as an anesthetic by dentists in "painless" tooth extraction. But what is the cause of these changes? When a portion of rich soil was heated, or submitted to the fumes of chloro form, it lost its property of decomposing the nitrates; on the other hand, when fresh soil was mixed with that heated, &c., the decomposition set in, because the animalcules (vibrious) existing in the fresh earth, attacked the organic matter, set free carbonic acid and hydrogen. The matter, seizing the oxygen of the nitrates, disengaged the nitrogen under the form of prot-oxyde. And the animalcules were readily detected, and were identical with the vibrious found by Pasteur in his celebrated researches on fermentation and decomposition."

ACCORDING to the Board of Trade returns, the imports for December increased £2,133,871, while the exports for the same month decreased £2,010,000, as compared with the corresponding month last year. The imports for the whole year increased £15,228,333, and the exports increased £7,454,478 as compared with 1881.

The falling off of over two millions sterling in the value of the exports last month proves conclusively that the trade of the country has received a serious check. It is to be observed, however, that the falling off is partly due to a fall in prices. The decline in the quantity of goods exported is not as great as in their value. No doubt a fall in prices means that the profits on the trade are smaller, and in not a few cases, we fear, it means that the profits have disappeared altogether. But still a decrease owing to a fall in prices is not so discouraging as diminution in the quantity purchased. There is, however, a diminution in quantities also, and not in one article only, but in most of the great articles of our trade, and in the quantities taken by so many countries that it would encumber our space to enumerate them. The most serious falling off, however, continues to be that in the cotton piece-goods sent to the Far East. For example, the falling off in the value of cotton piece-goods during December, as compared with December, 1881, bought by India, China, and Japan amounts to £454,000, or nearly one-fifth of the total falling off in the value of the export. There is also a falling off in the quantity of iron and steel exported, due partly to the check given to railway building in many directions. And generally it would seem that the purchasing power of foreign countries is not as great as it was some time ago. There can be little doubt that our merchants have overdone their business, that they have glutted the foreign markets, and that some time will be required before the stock thus accumulated is bought up and activity returns to our trade. But there is no reason to believe that it is anything more than a temporary check which we are now witnessing.

THE Government of India, Revenue, and Agricultural Department have made enquiries regarding sugar imported from Mauritius into the Bombay Presidency, and its competition with Indian sugars, the result of which may be summarised as follows:—In separate communications addressed to the Government of Bombay, to the Chief Commissioner of the Central Provinces, and to the Bombay Chamber of Commerce, the Government of India enquired what classes of sugar are mainly imported from Mauritius, whether they compete with the Indian article or are put to special uses, and to what extent the cost of railway carriage prevents the sugar-producer of Northern India from successfully competing with the importer by sea.

The replies of the Governments consulted, as also that of the Bombay Chamber of Commerce, have now been received, and are published for information. They show that the imports of sugar into the presidency fall broadly into two classes: (1) refined sugars, and (2) *gur*, a compost of sugar and molasses. The first class is almost exclusively supplied by Mauritius; the second mainly by sea-board from Madras. Such *gur* as comes from Northern India competes less with the refined sugars of Mauritius than with the shipments of *gur* from Madras. The imports from Mauritius meet a distinct demand for crystallised sugars, which at present Indian manufacturers make very little attempt to supply, and therefore a reduction of railway freight, although it might enable the *gur* imported by rail to compete on more favourable terms with that coming from Madras, would not divert the trade in refined sugars from Mauritius to Northern India. Meanwhile the demand for *gur* throughout India fully equals, it is believed, the supply, and this is probably one of the causes which retards the development of sugar refining in the Bombay Presidency and elsewhere. The area under sugarcane in the Bombay Presidency and in the Central Provinces is, however, increasing, and the time may, it is trusted, be confidently anticipated when the indigenous article will displace to a great extent the refined sugars of various qualities at present imported by sea from Mauritius and China.

C. B. Pritchard, Esq., Commissioner of Customs, Opium and Abkari, Bombay, states that when the price of sugar is quoted for various ports of the Bombay Presidency at rates ranging from Rs. 7 to Rs. 17 per cwt., some of the quotations must be for coarse undrained sugar (*gur*), others for refined sugar, and others again must be averages struck from the prices of refined and unrefined sugar. Rs. 7 is somewhat below the present average price of *gur* in the city of Bombay, while Rs. 17 fairly represents the price of refined sugar.

Gur was formerly sent in large quantities from Northern India to Bombay for Guzerat, but since the opening of the Rajpootana Railway it has been sent direct, and very little, if any, now comes to the city of Bombay. When it used to be brought by this route, its price in Bombay ranged from Rs. 6 to Rs. 10 per cwt. *Gur* is largely imported into the city of Bombay from the Madras Presidency, from coast ports in this presidency south of Bombay, and by land from Kolhapore. The present price of this *gur* may be quoted from Rs. 6-8 to Rs. 10 per cwt., but as will be seen from the following table the average declared value in the years 1879-82 was over Rs. 9 per cwt.

Import of Gur from Coast Ports, including Madras Presidency—

YEAR.	Quantity.	Declared value.
	Cwt.	Rs.
1879-80	187,238	17,68,021
1880-81	194,789	18,90,484
1881-82	185,848	17,43,946

The imports of Mauritius and China sugar in the same period were as follows:—

		1879-80.	1880-81.	1881-82.
Mauritius.				
Sugar, refined ...	Cwts.	504,552	742,892	602,967
	Rs.	82,03,073	1,19,34,726	95,41,495
,, unrefined ...	Cwts.	1,293	2,226	1,218
	Rs.	4,768	8,921	4,601
China.				
Sugarcandy ...	Cwts.	24,468	27,911	23,507
	Rs.	5,85,999	6,50,598	5,72,821
Sugar, soft, refined ...	Cwts.	52,849	1,12,882	89,465
	Rs.	8,74,990	18,75,432	14,72,318

In addition to the above, there have been importations of refined sugar to the following extent :—

		1879-80.	1880-81.	1881-82.
From Calcutta ...	Cwts.	98,075	27,387	89,265
	Rs.	14,93,788	4,48,087	4,86,490
From Coast Ports ...	Cwts.	17,460	3,811	16,425
	Rs.	1,48,310	63,389	2,43,426

Of the imports from Mauritius, only a very small portion is *gur*. This is inferior in quality to Indian *gur*, its present selling price ranging from Rs. 3-2 to Rs. 3-12 per cwt. Four qualities of refined Mauritius sugar are recognized in the Bombay market. Prices during 1881-82 may be quoted at from Rs. 18-8 for the first to Rs. 14-4 for the fourth quality; at present the prices are from Rs.16-12 to Rs. 13 per cwt.

The prices of China refined sugar (*soft*) in 1881-82 may be quoted at from Rs. 15 to Rs. 17-10 per cwt., present prices ranging from Rs. 14-8 to Rs. 17. The price of China sugar-candy was from Rs. 20 to Rs. 25 per cwt. in the year 1881-82; present prices ranging from Rs. 20 to Rs. 22 per cwt.

It is not practicable to separate the re-exports of Mauritius sugar from Bombay from the aggregate re-exports of sugar of all kinds. The total re-exports are stated below :—

Re-exports to Foreign Countries, chiefly Persia, Turkey in Asia, Arabia, Zanzibar, Mozambique, Ceylon, and Aden.

		1879-80.	1880-81.	1881-12.
Sugar, refined ...	Cwts.	48,296	109,443	69,843
...	Rs.	8,26,849	19,37,846	12,37,024
,, unrefined ...	Cwts.	165	...	...
...	Rs.	1,575	...	...

Re-exports to Coast Ports, chiefly to Kurrachee and the Cutch and Kattywar Ports.

		1879-80.	1880-81.	1881-82.
Sugar, refined ...	Cwts.	207,971	293,542	234,004
...	Rs.	34,49,117	49,99,354	39,67,512
,, unrefined ...	Cwts.	933	1,094	345
...	Rs.	10,943	4,135	4,082

The Hindoos formerly had a prejudice against Mauritius refined sugar on account of the use of blood in the refining process, but this prejudice has been overcome or forgotten, and Mauritius sugar is now used by all sections of the community. Mauritius sugar cannot be said to be used for any special purpose to the exclusion of Indian sugar, but it is preferred for the purpose of making sweetmeats, being found, when boiled down, to be more free from foreign substances than Indian sugar.

THE Acting Secretary to the Bombay Chamber of Commerce says: that sea-freights are of course liable to considerable fluctuation, but the average cost of carrying one bag of sugar, weighing 1 cwt. 2 qrs., from Mauritius to Bombay, may be taken at 10 annas, while from China to Bombay it may be taken at Rs. 1-9. The average fluctuations are, we believe, from 8 to 12 annas from Mauritius, and Rs. 1-6 to Rs. 1-12 from China, while in both cases I give you the medium rate. The present charges by railway for the same weight of bag from the several stations on the other side of India are, I understand, as follows :—

By rail from—	Rs.	A.	P.
Benares to Bombay	3	2	8
Allahabad to Bombay	2	13	6
Mirzapore ,, ...	3	0	2
Delhi ,, ...	4	3	0
Lucknow ,, ...	3	6	2

The prices at present ruling in Bombay for the different sorts of sugar are as follows :—

Bengal.

Casi	No. 1	Rs. 24	per 168 lbs.
,,	,, 2	,, 22—23	,, ,,
,,	,, 3	,, 20—21	,, ,,
,,	,, 4	,, 18-8 to 19-4	,, ,,
Domo		,, 15—18	,, ,,
Khujooria	,, ,,	,, 17—18	,, ,,
Cossipore refined crystals		Rs. 17	,, ,,

Mauritius.

Small white dry crystals, Nos. 1 to 3,	Rs. 16-12	to 15-12	per 112 lbs.
Large ,, ,, ,, ,,	,, 17	to 15-8	,, ,,
Soft white ,, ,, ,,	,, 15	to 13-8	,, ,,

China.

No. 1	Rs. 5-8 to 5-10	per 28 lbs.
,, 2	,, 4-8 to 5	,, ,,

The Committee are informed that the chief advantage which the Mauritius sugars have over the Indian sugars is that they are much more highly crystallised, which makes them more suitable for native confectionery of all kinds. In preparing sweetmeats the sugar has to be washed, and in this process, in its present form, the Indian sugar wastes about 5 per cent more than the Mauritius. China sugar is not highly crystallised, but it is whiter and sweeter than the Indian sugar, and consequently commands a comparatively higher price.

The Committee are informed that the Cossipore Sugar Factory at Calcutta is the only factory on the Mauritius system whose produce is known in this market. It is of a highly crystallized character, but being manufactured from inferior dates and not from the usual canes, it is said to be deficient in sweetness or saccharine matter, consequently it does not command as good a price as the Mauritius sorts. The quantity, however, of this description of Cossipore sugar sent here is very insignificant.

WE understand that the Government of Madras has decided to encourage the cultivation of divi-divi as widely as possible. There are immense tracts of land in the presidency in which it is believed that the trees would grow well, as they are very handy and very little care is required in their cultivation. An inspection was recently made of a divi-divi plantation at Perambore which promised to prove very successful. About seven acres had been planted with divi-divi, all produced from seed from two parent trees, which are about 25 years old. The produce of these two trees during the past year had amounted to 560lb of pod, which, when sold, realised Rs. 18-10 nett. The dried pods fetched in the London market prices varying from £13 to £19 per ton. The owner of the Perambore plantation had, it appears, received offers for the seed at the rate of Rs. 12 an ounce, and for seedlings he had been offered Rs. 6 per hundred. Besides being of great value as a tanning and dyeing material, the divi-divi is also utilised for the manufacture of ink, and some ink which had been made on the plantations was pronounced to be exceedingly good.

No regular trade appears to have been established yet for divi-divi in Madras, but the following statement, which gives the quantity and value of the pods exported during the past five years, proves it is to be a profitable product—

COUNTRIES TO WHICH EXPORTED.	1877-78.		1878-79.		1879-80.		1880-81.		1881-82.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.
United Kingdom ..	165	660	15	73	109	580	150	685	88	586
Calcutta ..	..	..	..	..	..	..	..	..	45	285

IT is very apparent, from the letter which we reproduce in our correspondence columns, that the analysis of soil given in the report of the Cawnpore Farm Experiments is not only by itself of very little value for practical agricultural purposes, but on the showing of our correspondent, it is positively misleading. It seems to us a matter much to be

deplored that some such explanation as that now forthcoming did not accompany the report when it originally appeared. Chemical analysis of soil at the best does not accomplish what the bulk of fairly educated men give it credit for achieving. Even conducted under the most favourable conditions it would be rashness in the highest degree to claim for it more than a sort of average result, while it is very doubtful if the same experimenter taking fresh samples of earth from the same field and conducting his analyses under identical conditions would be able to arrive at absolutely identical conclusions. As our correspondent says, "Those who know most about agricultural chemistry put the least trust in the results of an analysis."

We would go further, and say, that an analysis of soil while it may confirm the results of field experiments, it would nevertheless be the height of folly to appeal to analysis as a confirmation of field experiments unless both had been conducted in such a way as to eliminate all the possible sources of error; and this implies an application of crucial tests under every conceivable condition, and combination of conditions, to which in our estimation the Cawnpore Farm field experiments can lay no claim. In our opinion the limitation of Mr. Fuller's generalization by our correspondent requires still further limitation.

Professor Dyer of Kew, has sent to India specimens of three kinds of wood taken from tea-boxes which had been sent home from India, probably from Assam. He says:—

"The enclosed pieces of wood are fragments of India tea-chests. We are anxious if possible to know the names of the trees which furnished them. A curious question has arisen about them which may lead to a lawsuit. Wood No. 3 has produced the complete corrosion of the lead with which the chest was lined. The metal is in fact converted into a coating of carbonate of lead, which you will see as a white incrustation on the surface of the wood. The result of this has been that the tea became damp, and deteriorated during the voyage. Nor was this the whole of the mischief; the wood has a sour acid smell which it communicates to the tea. All the chests packed in this wood proved practically unsaleable in London. It is therefore important to find out what this objectionable wood is, and gibbet it as a thing to be avoided for the purpose in the future. If you can help us with any information about it, we shall be grateful to you."

Mr. J. S. Gamble, to whom the specimens were sent, says in a note to a contemporary, as far as a mere guess from resemblance and the descriptions in the "Manual of India Timbers' goes, the woods were—

No. 1. *Erythrina indica or suberosa* (certainly).
„ 2. *Derris robusta* (probably).
„ 3. *Mangifera sylvatica* (probably).

Professor Dyer's description of the odour and appearance of No. 3 was quite correct, but in order to make sure and also to ascertain if the wood of the wild mango is usually one of these used for tea-boxes, I have sent the specimens to Mr. Mann for his opinion, and hope to communicate the result to the *Forests*.'

It will be a most important matter to warn planters of the damage such woods are likely to cause to their tea, and it is therefore to be hoped that we may be able successfully to trace the tree which gives such an unpleasant wood. I have known "champ" wood in Darjeeling give a similar scent, but the specimen was not "champ," which besides is not used for tea-boxes. In Darjeeling the common tea-box woods are—

Terai.—1, Toon; 2, Lampatia; 3, Semal; 4, Goguldhup; 5, Kadam; 6, Mandania; 7, Mainakat; 8, Udal.
Hills.—1, Toon; 2, Kabashi (maple); 3, Mahua; 4, Gobria; 5, Chilanni; 6, Lepchaphal; 7, Parsing—

while the Chittagong toon and others not well known are used; and in Chota Nagpore I have seen salai employed. Perhaps some one will favor us with a list of Assam and Cachar tea-box woods and help to complete the list.

The following note by Baboo T. N. Mookerjee of the Revenue and Agricultural Department, regarding the Divi-Divi (*Cæsalpinia coriaria*) has been circulated to the Forest Department with the following queries:—

(1) Whether the information contained in the note is correct.
(2) Whether the Department can add any further information.
(3) What part of India is believed to be the best for its cultivation.
(4) What steps the Forest Department is disposed to recommend to extend the cultivation.

Divi-divi is the pod of a leguminous tree known in botany as *Cæsalpinia coriaria*, *Libidia coriaria*, or *Poincinania coriaria*. The pod itself is also called Dibi-dibi, Libi-libi, or Libi-davi. It is a native of South America and the West Indies, and is chiefly found in low marshy situations in New Grenada, Mexico, Venezuela, North Brazil, and Jamaica.

2. Dr. Wallich introduced it into India about the year 1830, and it has now been thoroughly acclimatised in South India, which, in soil and climate, resembles its original home. As the plantation near the Government Harness Factory at Cawnpore proves, it can be, with a little care, successfully cultivated in the drier climate of Upper India. The hot winds in the summer and the frost in the cold weather are, however, very destructive to the young seedlings. The seeds therefore should, in the first instance, be sown in a nursery in May or June, before the commencement of the rains, and the seedlings should not be transplanted till they are at least three feet high, by which time, it is supposed, they will be sufficiently strong to endure all the variations of weather to which Northern India is subject. In planting out, the trees should be put down 6 feet apart, so that an acre of land will contain 1,210 trees. Irrigation will be necessary as long as the trees are not sufficiently grown up to dispense with it. The *ghara* system of irrigation can be advantageously employed. In South India the tree takes three years to arrive at maturity, but in a drier climate it will perhaps require a longer period. Indian botanists recommend the cultivation of Divi-divi as a profitable, as well as an ornamental, plant.

3. The tree is cultivated for its seed-pods, which contain a large quantity of a most powerful and a quickly-acting tanning material, rather too strong to become a substitute for oak or babul bark, but very valuable as a cleaning aud brightening agent in the after-process of currying, when it takes the place of sumach or *Rhus coriaria*. Both in England and at the Cawnpore Government Factory it is used as a substitute for sumach, which is a dearer article.

4. The actual demand for Divi-divi pods is not known, England imports about 4,000 tons every year, in addition to about 12,000 tons of sumach. But as Divi-divi is gradually ousting the latter, its demand appears to be capable of great expansion. For the same reason France, which now annually imports more than five million kilogrammes of sumach, will probably become a large market for this article. It has been proved beyond doubt that the tree can be profitably cultivated in India, and the quality of a consignment sent two years from the Khandesh Farm (Bombay) was pronounced by experts in England to be very superior, and fetched a higher price, than that imported from the West Indies. One great advantage in its cultivation is, that the tree requires no care after it has once grown up, and the proceeds are net gain *minus* the trifling cost of picking the pods. The ground underneath could be used for raising fodder grass, and the falling leaves for fuel or manure, the three great wants of the Upper Provinces. An acre of Divi-divi is supposed to yield not less than one ton of marketable produce, valued in India about Rs. 100, in England Rs. 150. The following are the actual results of the trial consignment mentioned above:—

	£	s.	d.	£	s.	d.
Amount realised by sale of 14 cwt. 18 lb. of Divi-divi in London, at £15 per ton.	10	12	5			
Less discount at 2½ per cent ...	0	5	4	10	7	1
Charges in London ...				3	9	6
Balance				6	17	7

	Rs.	A.	P.
Equivalent of £6 17s. 7d. in Indian money, at 1s. 7½d.	83	1	1

	Rs.	A.	P.	Rs.	A.	P.
Brought over ...				83	1	1
Less Indian Expenses.						
Railway charge form Khandesh to Bombay	13	10	0			
Cart-hire in Bombay	2	8	0			
Shipping Charges, bunder fees, bill of lading, &c.	3	15	0			
Addressing on 15 bags containing the pods	9	6	0	29	7	0
Net proceeds ...				53	10	1

It is not, however, known how many trees or what area of land gave the above proceeds. But Mr. Stormont, the Superintendent of the Khandesh Farm, who sent the consignment, reckons upon Rs. 80 as the net proceeds from one ton of Divi-divi on one acre of land, after paying the heavy export expenses. These expenses, he states, can be reduced by sending the article loose in ships' hold, as a packing material for bulky goods, in which state the Atlantic shippers are glad to receive it at quite nominal rates.

Dr. King is not of opinion that the cultivation of Divi-divi will turn out a hopeful financial prospect in Lower Bengal, and has furnished the following note :—

"The Divi-divi has been in cultivation in Bengal for many years. But although the value of its pods as a tanning material is well known, the cultivation of the tree has never excited much interest in the province. Seeds and plants of it have been available for distribution from this garden for years past. But they are very little asked for. The reason for this is no doubt the slow growth of the tree in the soil of Lower Bengal. Trees of it in this garden, which are certainly not less than from 18 to 20 years are only from 10 to 18 feet high. They have, however, large spreading heads. For example, a tree 18 feet high has a leafy head measuring 55 feet in diameter. On this account a comparatively small number of mature trees could be carried on an acre of land. I observe that in paragraph 4 of the Memorandum by Baboo T. N. Mookerjee, forwarded by the Government of India, it is mentioned that fodder grass could be grown under the shade of Divi-divi trees. This would not be the case in Bengal, as the shade is so dense that absolutely nothing will grow under a mature tree."

On the whole, Dr. King is of opinion that in Lower Bengal the cultivation of Divi-divi is not a hopeful financial project. Regarding Behar and the drier parts of the province, he speaks less confidently ; but is not inclined to think that even in these parts it would be advisable to press the cultivation on landholders or tenants as a source of revenue.

Mr. Benett, the Director of Agriculture and Commerce, speaks more hopefully of its prospects in the North-Western Provinces. We extract the following from his Report :—

"Various attempts have been made in these provinces to cultivate the Divi-divi. Three sowings were made at the Saharunpore Gardens in April, May, and June, 1879. In all three trials, the seedlings after attaining a height of one inch or so, died down under circumstances which led the Superintendent to infer that the seed supplied was to blame. Another trial was made on the banks of the canal near Cawnpore. The experiment was initiated under the care of an officer, whose interest was enlisted in the matter, but a change of officers subsequently occurred, and the experiment was finally reported as a failure, accompanied by an expression of opinion, that of all civil officers, canal officers had the least leisure for looking after such matters. In neither of the above instances can the tree be said to have had a fair chance. At the Cawnpore Experimental Farm about 10 seedlings were reared three years ago. Of this number one or two, which were transplanted to very poor soil, perished. The remainder were transplanted to fairly good soil, and have all done well, but have so far shown no signs of fruiting.

"At the Harness Factory, Cawnpore, about 3,500 trees have been successfully raised, and more are now being planted.

"From information kindly supplied by Captain Stone, in charge of the Harness Factory, it appears that the proper time to sow the seed is either March or July. If sown in March, the seedlings should be transplanted in the following July ; but, if sown in July, transplanting should take place in July of the following year. The trees commence to fruit in from 3 to 4 years after transplantation, and yield about 5 lbs. per tree. They grow to a maximum height of 15 feet, and planted from 12 to 15 feet apart. As a general rule, in tree planting to allow full scope in growth, a distance between trees in a plantation should be maintained of one-and-a-half time their height. Assuming, that 15 feet intervals will suffice, we have 192 trees to the acre yielding 8½ cwt. of pods per annum, worth Rs. 42-8 to Rs. 100 per ton, from which sum again has to be deducted the cost of carriage to the coast.

"Allowing 10 feet intervals, the number of trees per acre will be 436, and the annual produce 19½ cwt., at Rs. 100 per ton, Rs. 97-8, but it has yet to be shown how far the lessening of the interval between each tree affects the estimated produce.

"The tree is admittedly delicate, requiring care, irrigation, and good soil. It seems doubtful from the figures given above whether good soil in these provinces, distant as they are from the coast, would not yield a larger profit if laid down in good fruit trees ; but the evidence so far either for or against the maintenance of Divi-divi plantations is inconclusive, and with the approbation of his Honor, experiments and enquiries will be instituted by this Department, with a view to obtaining more exact information.

"A small supply of seed has been obtained from the Superintendent of the Harness Factory, and is now being planted out at Lucknow. Efforts will be made to obtain a good supply of West Indian seed for distribution by March next, and care will be taken to give the seed a trial under fair conditions."

Experiments regarding its growth are also in progress in British Burmah.

BARLEY CULTIVATION FOR INDIA.

(*Communicated.*)

Class ...	...	... Monocotyledoneæ.
Natural Order ...	...	... Gramineæ.
Scientific typical names ...		Hordeum vulgare, Linné.
		,, distichon, do.
		,, hexastichon, do.
		,, deficiens, Steudel.
		,, zîecriton, Linné.
English general name	...	... Barley.
Hindustani name	...	... Jao.
Bengali name ...	...	... Job.

Introduction.

The barley plant has been under cultivation from the most ancient time, and has always been held in great esteem as supplying food to man and *animated nature* under the protection of man. We find it mentioned in very high terms in the Bible—*vide* Deut. viii, 7 and 8; Jer. 2, xi, 8. Notwithstanding all the recent discoveries made in the vegetable kingdom introducing plants possessing more valuable properties for food, barley still maintains its character; and is most conducive to the wants and comfort of the millions of poor people and live-stock of all kinds (including the very valuable breeds of Arab and and Barbar horses, which are exclusively fed with barley corn), and in all parts of the world. Indeed, at the present time, in extensive cultivation, barley stands first of all plants of the natural order *gramineæ*, wheat standing second, and rice third, in the list. Speaking about India, barley cultivation is far more extensive and general than any other cereal grain plant in this country. This might be said of barley in other parts of Asia, Africa, Europe, and America ; the reason of this extensive cultivation, because of equally extensive consumption, will appear from the facts delineated further on.

Classification of Barley.

Botanists, with due regard to botanical characteristics observed in the ear of barley plants, have classified and placed them under five types described above. Since it will be found useful and interesting to persons wishing the improvement of the indigenous varieties of barley of India, and the introduction of new varieties from other parts of the country and the world, I accordingly subjoin a list of the principal cultivated varieties, together with a description of such of them as may help towards an improvement in the barley cultivation in India.

I.—Hordeum vulgare (the four-rowed barley).

To this type beloging the following varieties :—

1. Spring Barley.
2. Summer or Sand Barley.
3. Winter Barley.
4. Pearl Barley.
5. Black Barley.
6. Russian Barley.
7. French Barley.
8. Naked Barley.
9. Wheat Barley.

In this list pearl barley, a sub-variety of winter barley, is the most valuable. It is very hardy, a heavy cropper, the earliest in coming to maturity, and the grain containing the largest percentage of gluten of all barleys under cultivation : the stem and foliage are also very nutritious fodder for the live-stock.

Pearl barley therefore recommends itself as the best barley for food for man and animals. Pearl barley, however, is not suited for malting purposes as well as other barleys are ; so much the better for India, India requiring food, and not beer, porter, wines, spirits, intoxicating drugs.

Summer barley has the advantage over other barleys in that it will grow on the poorest soil, can be malted, but is poor in yield ; because it has been grown from generation to generation on soil deficient in food ingredients necessary for its growth.

The other barleys, under this heading, do not require any special notice. Our Indian barleys, as found in Upper India, belong to *H. vulgare.*

II.—Hordeum distichon (common two-rowed barley).

Varieties—

1. English Barley.
2. Chevalier Barley.
3. Annot Barley.
4. Dunlop Barley.
5. Long-eared Barley.
6. Black Barley.
7. Large Barley.
8. Italian Barley.
9. Golden Barley.
10. Liberian or Halliday Barley.

All of these varieties are suited for food for man and animals ; and excepting the Liberian or Halliday barley, are also well adapted for malting.

III.—Hordeum hexastuhon (the six-rowed barley.)

Varieties—

1. Red Barley.
2. Scotch Barley.
3. Square Barley.
4. Bear Barley.

These barleys are noted for their easy culture, freedom from rust diseases, and for strong and firm stems which enable them to stand erect and brave wind and rain. All of them can be malted.

IV.—Hordeum deficiens (the Red Sea two-rowed barley).

This barley is most extensively cultivated in Arabia, Egypt, Abyssinia, and other parts of Africa. The strength and swiftness of Arab and Barbar horses are derived from this barley with which they are fed. This and an allied species, *H. macrolepis* (A. Br.) are rarely cultivated in any other part of the world, and might be introduced into India as valuable for feeding live-stock.

V.—Hordeum zeocriton (the Tartar two-rowed barley).

Varieties—

1. Sprat Barley.
2. Battledore Barley.
3. Fulham Barley.
4. Putney Barley.
5. Rice Barley.
6. Turkish Barley.
7. Dinkel Barley.

No special notice seems necessary regarding these barleys. In properties they are similar to the varieties of *H. distichon*, slightly differing from them in botanical characteristics.

USES.

The two parts—(1) seed or grain, and (2) stem and leaves, are valuable.

(1) *Seed or grain.*—From time immemorial, in every part of the world, barley grain has served as food to man and animals. In India it forms the staple food of the agricultural population, and millions of the poor of India, the rich also consuming it. The natives of India have different methods of preparing and using this cereal grain. A few words regarding these may be interesting.

A.—BARLEY, MIXED OR UNMIXED, AS FLOUR.

In India barley is rarely used singly for flour, but in most cases it is mixed with pulses and wheat, and then milled into flour. This is done in order to improving the flavour and nutritive properties of barley, hence poor people blend barley grain with wheat and pulses ; no poor people will eat barley alone without one or more admixtures described above. With this end in view Indian cultivators raise barley as a mixed crop, and in the bazaars barley is sold as a mixed grain. Rich people, however, do not like admixtures ; for them, therefore, barley is raised singly, and sold as an unmixed grain. So that barley is to be found in two states in the Indian markets—mixed and unmixed. Those who are not agriculturists (if mixed barley grain be not found in the market) purchase, according to taste, one or more pulses and wheat, blend them in different proportions with barley, reduce the whole into flour, and convert the flour into bread. By doing this, superior relish and economy in the cost of living are effected, wheat alone being so very costly that poor people cannot afford to buy.

Believing that it will be interesting and useful to those wishing to make experiments for ascertaining the effects produced on human or animal body, I join the different kinds of blendings with barley corn practised in India :—

1st blending (gojao H.)	Wheat (*Triticum vulgare* ...	25	
	Barley (*Hordeum vulgare*) ...	75	
		—	100 parts.
2nd blending (jao-chana H.)	Barley	50	
	Gram (*Cicer arietinum*) ...	50	
		—	100 "
3rd blending (jao matra H.)	Barley	50	
	Green Pea (*Lathyrus sativum*) ...	50	
		—	100 "
4th blending (jao kerao H.)	Barley	75	
	White Pea (*Pisum sativum*) ...	25	
		—	100 "
5th blending (bijhra H.)	Barley	50	
	Grain	25	
	Wheat	25	
		—	100 "
6th blending (bijhra H.)	Barley	50	
	Green Pea ...	25	
	Wheat	25	
		—	100 "
7th blending (bijhra H.)	Barley	50	
	White Pea ...	25	
	Wheat	25	
		—	100 "
8th blending (bijhra H.)	Wheat	25	
	Barley	25	
	Gram	25	
	Green Pea ...	25	
		—	100 "

Of these bleudings, the last one is very superior, having all the nutritive ingredients necessary for the nourishment of the body, and is that with which experiments should be commenced. In feeding live-stock I would recommend, on physiological grounds, the mixed grain, whichever of these blendings is desired to be experimented with, to be reduced to flour, and then administered. A two-fold object is gained by this procedure, *viz.*, easy digestion, and economy in feeding, the cost of milling being covered by the less grain given, and the feeder is advantaged by the health and strength imparted to the animal on which experiment is made. I might as well note here that on experiments with cattle, I have failed to get broken grain thoroughly digested by the animal, having on examination found broken grain in the dung of the animal so fed ; but succeeded very well with flour which was thoroughly digested. Uncrushed or whole grain is still more difficult to be digested by animals, because it taxes and weakens the digestive powers too much. Horses have been found to digest this kind of food better than cattle, the latter having been found to pass it off with the dung in the very state it was administered. Our object in feeding these and other animals should therefore be not to tax and break down the digestive powers of animals—a very great point to persons wishing improvement of live-stock, and economy in feeding. Barley is a cooling food, and therefore very appropriate food for man and animals in India all through the summer and rainy weather. It is on account of this valuable property of barley, that Arab and Barbar horses fed with barley corn can bear more fatigue in the hottest part of the world than the best Indian horses, because Indian horses are fed with the heating grain all through the year—the Indians not knowing or over-looking the scientific theory—*heat exhausting and cold bracing*—a theory holding good anywhere and everywhere.

B.—BARLEY AS SUTTOO.

Suttoo is a well-known artcle of diet in Upper India, extending in the east from Western Bengal to the Afghan Frontier ; on the west down south to the Central Provinces. In Bengal Proper, *suttoo* is rarely eaten, nor have I found it in vogue in any other part of India. It is peculiarly a poor labouring man's midday meal, which he prefers at this time for two reasons—firstly, because at midday he is allowed only a couple of hours' leave for refreshment, which he finds insufficient for the tedious and time-absorbing work of cooking and cleaning of cooking utensils ; and, secondly, because economy is effected by eating *suttoo* at midday, and cooked food in the evening, after freedom from a day's work. There are three kinds of *suttoo* made in Behar, North-West Provinces, Oudh, and the Punjab—(1) of pure barley grain, (2) of barley and grain in equal proportion, and (3) wheat and barley grain in equal proportion.

These three kinds of *suttoo* are prepared as described below :—

The persons desirous of getting *suttoo* made takes his grain, mixed or unmixed, according to choice, to the *bharbhooja* whom he requests to fry it for him, remunerating him with either a little grain or a few *gundas* of *cowrees* (if the quantity to be fried be little), or even seers of grain or annas of pice (if the quantity to be fried be large). On receipt of the remuneration the *bharbooja* (a class of Mahomedan and Hindoo people going by this name) proceeds to fry the grain thus ;—adjoining his *bhoosa* (a long oven) the *bharbhooja* has a wide mouthed earthen vessel in which, according to its holding capacity, he, his son, or one

of the female members of his family called *bharbhoojin*, puts a quantity of grain; then he or she puts a quantity of burning sand from one of the *hauryas*, generally 12 in number fixed on the *bhaur* (two rows of six *hauryas*), and by means of a large iron spoon mixes the sand with the grain, sieving the sand out through an iron sieve. This finished, the grain is examined to find whether it is sufficiently fried or not. If found sufficiently fried, the fried grain is kept aside, and the remaining unfried quantity is fried in the same way; but if the grain be found insufficiently fried it is again fried, as at first, with another admixture of burning sand from the *haurya* fixed to the oven. Generally one frying is sufficient, but when the sand is not powerfully heated two fryings become necessary. After the grain is fried it is taken to the home of the person, and the female members of his family, if any, proceed to separate the husk of the fried grain by means of a lever-mill (*dhenki*, H.) or by means of a wooden pestle and mortar (*moosal* and *okhal*, H.), fanned out by means of a *soop*, H., and the clean grain milled in the same way as wheat or any other grain is reduced to flour. The flour thus obtained is called *suttoo* H. or *chuttoo* B. If, however, the person has no one at his lodgings to prepare *suttoo* for him he gets it prepared by either the *pisnharin* (female miller), or he gets it done by the *bharbhooja*, for which additional labour he has to be remunerated in cash or in kind as for frying, but somewhat more. *Bharbhooja's suttoo* is not properly made. This professional man does not bestow the proper time and labour on the preparation unless exorbitantly paid, but allows a great deal of husk to remain, and the milling is also very coarse. On these accounts, Indian people, whenever and wherever possible, prefer getting *suttoo* made either at their own homes or by the *pisnharin*, this woman being paid at the rate of wheat flour, at so much per every five seers called *pansers*.

Now, *suttoo* is eaten in two ways, *i. e.*, with sugar, and with salt. *Suttoo* made of pure barley corn, or barley and wheat is eaten by poor people mixed with *goor* or *rab*, moistened with water, the rich people using *cheene*, *khand*, or *misree* (refined sugar) scented with rose or *Keora* water, dissolved more or less, according to taste, with water. The upper classes of Hindoos and Mahomedans, whether of Upper Provinces or of Bengal eat *suttoo* in this way; but the millions of poor people eat *suttoo* composed of barley and gram mixed with salt and water with the addition of green chillies. In addition to these uses, *suttoo* is largely consumed in feeding valuable horses and costly cart bullocks, for which purpose *suttoo* composed of barley and grain, is preferred.

These are the different uses to which barley grain is put in India. In Europe and America, however, other uses are found. Beer and porter are brewed from barley-corn, and the starch used in laundries, perfumery, and various other articles are made from barley.

STEMS AND LEAVES.

(2.) Valuable fodder for the live stock can also be used, where abundant and available, for thatching purposes and bedding of live-stock. The dung of animals fed on the straw and litter used in housing them are excellent manure.

J. B.

(To be continued.)

NOTICES OF BOOKS.

THE QUINA BARKS.

A BOOK* has recently been published in Berlin, by Professor Flückiger of Strassburg, on the subject of quina† barks. It contains 79 pages and eight lithographed plates, and is divided into 18 sections, under the following heads:—Origin; most important cinchonas; Remijia; home of the cinchonas; culture of the cinchonas; gathering of the barks; appearance and anatomical structure of the cinchona barks; composition of the tissue; seat of the alkaloids; varieties of cinchona barks; so-called false quina barks; quina cuprea; commercial statistics; chemical constituents of the quina barks; quantitative analysis of the alkaloids; manufacture of quinine; history of the quina barks up to 1737; recent history of the quina barks; list of recent works on the cinchonas and quina barks. The following is a translation of the preface attached to the work:—"The most important vegetable medicines corresponding with the progress of development of mankind are or were in large measure of oriental and south European origin. America at first contributed but few gifts, and that to which now in domestic economy such an extraordinarily pretentious importance attaches, tobacco is of no importance in medicine, although nicotiana first found an entrance into Europe as a 'wound-wort.' A century later there arose from the American plant world in quina bark a medicine whose action has found ever increasing recognition even in the face of the severest criticism of the present age. The market of the world may, by means of the sums of money it puts into circulation, indicate this bark as a most important medicine, but its value to-day rests much more on the fact that it is of service to the industry as a raw material. Since the discovery of quinine, and the consequent immediate commencement of its manufactural production, the pharmacognostic importance of quina bark has altered commensurately; the greater certainty in the quantitative analysis of the alkaloids also has had the effect of throwing into the background an external knowledge of the bark as such. The revolution is taking place slowly; until quite recently in the pharmaceutical literature, the heading 'Quina Barks' still flourished in its pristine exuberant luxuriance. The progress in the culture of the cinchonas necessitates now another consideration of Chinchonology (Chinology or Quinology), as, with scarcely correct emphasis, this section of pharmacognosis is called. Unfortunately, the materials are still to a great degree wanting to carry this out to a satisfactory conclusion. For a systematic view the botanical knowledge of the plant-group under consideration leaves much to be desired, not to speak of the anatomical investigation of the structure of their barks. Even on the most important question, the increase of the alkaloids in those plants, we are deficient in information. The sudden flooding of the market with the Quina cuprea, which does not belong to a cinchona, especially differing throughout in respect of its tissue from the quina barks in the narrower sense, has brought to light for the whole world the surprising fact that quinine and the allied bases are not confined to the genus cinchona. The new views which are forced upon us by these observations lie quite outside of the allied question, what plants within the circle of the cinchoneæ generally contain quina alkaloids. The answer can meanwhile be only a very imperfect one. A variety of interesting topics are connected with the quina barks, both traditions, which have been and remained dear to the pharmaceutists and physicians, and also glances into the future which are equally worthy of more detailed consideration. I was desirous, in bringing forward these views to the light of the present, to clear away the not always refreshing material of past ages and to open the road to a better insight. The short track which I have been able to make in this direction shows, however, some advance and invites to further labor. The following pages are, with a view to a larger circle of readers, taken from my 'Pharmakognosi,' but are fuller in many points; the importance of the subject appeared to me to justify such a proceeding. In this I have been assisted in the most obliging manner by my friends, Dr. J. E. de Vrij, C. S. I., in Hague, and Dr. G. Kerner (Zimmer quinine manufactory in Frankfort)." So far the preface. In the first section of his work, Prof. Fluckiger describes in a general way the *cascarillos finos* or true cinchonas and the *cascarillos bobos* or false cinchonas, the former of which are confined to the mountain slopes of South America, while the latter are found much more widely diffused. Weddell's and Kuntze's divisions of the cinchonas are described, and the writer says:—"It is a question whether it is a gain to exchange the 51 varieties and sub-varieties of Weddell for the 14 varieties and bastards of Kuntze. Granted, however, that Kuntze was rightly informed as to the origin of the forms met with by him in British India and Java, it cannot be conceived why the wild growing South American cinchonas should correspond completely and entirely with those called bastards by Kuntze. Observations on plantations have certainly proved that crossings between cinchonas so nearly allied to each other can very easily take place, but in nature it is scarcely possible to distinguish whether we have to do with such a mixed offspring or with a form of a determined variety, produced by influences in some other manner. The view of Baillon, that about 20 varieties of cinchona are to be recognized, though not further confirmed, may still be the most correct one." Section 2 of the book deals with the most valuable cinchonas, *viz.*, succirubra, calisaya, lancifolia, and officinalis, the "robusta" of Trimen being mentioned under the first, and C. Bolliviana and C. Ledgeriana being described under the second. The third section is devoted to Remijia, 11 varieties of which are mentioned on the authority of Triana, the R. purdieana and R. pedunculata being specially referred to, as furnishing the barks described as quina cuprea. In section 4, the home of the cinchona is defined and the conditions necessary for its growth are detailed. In the fifth section a summary is given of the history of the introduction of cinchona culture into India, Ceylon, Java, &c., and the diseases to which the plants are liable are mentioned. We translate the concluding portion of this section, referring to the so-called cuprea:—"The alkaloid yielding barks which, under the name of Quina cuprea, have of late attained to such surpassing importance, belong to the genus Remijia, which grows under entirely different climatic conditions from most cinchonas. If the forestry departments will now possess themselves of the valuable Remijias the culture of fever bark trees can be extended into wide tracts of land from which they have hitherto been excluded. Contrary to what is the case in regard to the cinchonas, the Remijias are not confined to the hill regions, but suited to bear drought and higher temperatures, which prevail for example in the climate of the llanos in the region of the Orinoco and Amazon. Very likely among these or other allied trees may be found others similar with quinine-yielding barks, which would repay cultivation." In the next section Prof. Fluckiger describes the methods of harvesting the cinchona bark in South America, and also the recently adopted processes of coppicing, mossing, and scraping. In section 7 the appearance and anatomical structure of the barks are described, section 8 dealing with the contents of the tissue and the seat of the alkaloids. In the next section the varieties of cinchona barks, calisaya, lancifolia and succirubra, as they are sent to the market, are described, "pata de

* Die Chinarinden in pharmakognostischer Hinsicht dargestellt von F. A. Flückiger. Mit VIII lithographirten Tafeln. Berlin, 1883. (The Quina Barks: considered from a Pharmacognostic View, by F. A. Flückiger. With 8 lithographed plates.)

† We have used this word to correspond to the "China" of the Germans ("Kina" in Dutch), which is a general term including the cinchona tree, barks, &c., and is applied by Prof. Flückiger, also to the "Cuprea" bark, which, as he says, does not belong to a cinchona.

gallinazo" being ridiculed as a fantastic name; "loxa" is also referred to. Section 10 treats of the so-called false quina barks, *viz.*, Cascarilla magnifolia or Quina nova, rosa, &c., which contain no quina alkaloids and generally no alkaloids whatever. The 11th section is devoted entirely to Quina cuprea, to which Prof. Flückiger was the first to call attention in 1871, though Mr. Howard had so far back as 1837 received a piece of this bark and had noticed its quinine-yielding property. Its first appearance in quantity in the London market took place in 1879-80, and since then the imports have been very large. Prof. Flückiger describes the external differences between it and true cinchona bark, the shape of the bark cells being very distinct; the cuprea bark also yields caffeic acid, which is not the case with other quina barks. Another bark, introduced with the cuprea bark, but differing from it, is described as cinchonamine bark. In section 12 statistics are given of the imports of bark during the last few years into London and other places, and the prices for quinine which have ruled in Germany, together with the probable consumption of the sulphate in that country. Sections 13 and 14 deal at length with the chemical composition of the quina barks and the quantitative analysis of the alkaloids, several methods being given for the determination of the latter, but a footnote stating that a quick practical method is still wanting. In the next section the manufacture of quinine is described, and the efforts of Broughton and Wood are referred to. Section 13 contains a succinct history of the quina barks up to 1737, and section 14 carries the history up to recent times, and concludes as follows:—" The settling of so many still open questions in respect of the cinchonas must be hoped from the forest culture of these trees, on the development of which the interesting official reports of the English and Dutch give continuous information. Very desirable is the complete systematic knowledge of the entire division of the cinchoneæ and the comparative examination of the barks of each separate variety from a chemical and an anatomical point of view." Section 18 gives a list of 38 of the latest works on the cinchonas and quina barks, Mr. Owen's manual being mentioned. An index adds to the usefulness of the work, which we hope will appear in an English form.

We may add that the value of Prof. Flückiger's work is enhanced by a series of well-executed engravings of various types of the true cinchonas and of one of the plants which yield the cuprea bark. The first engraving represents the characters, in stalk leaf, flower and seed, of cinchona succirubra from an example supplied by the late Mr. McIvor in 1875. The second picture pourtrays cinchona calisaya, var. ledgeriana, "nach Exemplaren aus Java," the male and female forms of the blossom being carefully distinguished, and the peculiar small round dots on the ledgeriana leaf being prominently shown. In the case of this most valuable of all species there is a separate engraving, also from a Java specimen, displaying fully the character of the seed capsules, natural size and magnified, the enlarging under the microscope revealing pubescence on the capsule. Next comes a portrait of *cinchona lancifolia*, also from a Java specimen, at once distinguishable from ledgeriana, by its much smaller leaves and its much more elongated blossoms and fruit capsules, the latter tapering more to a point than is the case with the short stumpy ledgeriana seeds. The specimen of *C. officinalis* figured represents a twig from Darjeeling and indicates characteristics of leaf, blossom and fruit, familiar to cinchona planters in Ceylon. Contrasted with this form are the long bean-like capsules of *cascarilla heterocarpa* (*magnifolia*) copied from Karsten's work on the Flora of Columbia. Finally, we have a figure of the principal type of the plants which, though resembling the true cinchonas in foliage, do not belong to them, but which yield a bark (cuprea) with much the same properties. The name of the plant figured in *Remijia pedunculata*, the cinchona pedunculata of Karsten's Flora of Columbia. The foliage is wonderfully like that of *C. officinalis*, but, after all is said and done, we do not believe cuprea bark is destined to supersede that of the true cinchona. The characters of the two barks under the microscope, as figured in this volume, show very marked difference. For purposes of comparison we have first a page devoted to figures showing cross sections through the young bark of *cinchona calisaya*, older bark of the same, and bark of *C. lancifolia*. The outside bark, the cells, the pores and other vessels and constituents of the barks are shown in careful detail, and comparison proves the vast difference in the fibrous matter of the true cinchonas and that of cuprea bark. A large section of cuprea bark, given separately, shows in a still more striking light the structural difference of cuprea bark from that of genuine cinchona. To chemists, especially quinologists and botanists, this work of Flückiger's will be of special value, while to the planter it is interesting as well as useful from the large amount of information it summarizes, and the well executed plates it contains of the leading species of the "Quina" plants, the cultivation of which in the Eastern World during the past quarter of a century has advanced so rapidly that there can be little hesitation in asserting there are now more cinchonas in Java, India, and Ceylon than could be counted in all the forests of the Andes.—*Ceylon Observer.*

SUBURBAN VILLAS.

Suburban Villas and Residential Farms in Kattywar, by Major H. L. Nutt, Bombay Political Department. Educational Society's Press, Byculla, Bombay, 1883.

MAJOR NUTT's little pamphlet is very carefully and neatly got up. The plans and estimates are accurate, full and easily understood. In advocating a system of Residential Farms, Major Nutt does not propose a sudden radical change in existing habits and customs. He hopes for a gradual and systematic improvement among agriculturists, by chiefs and other leaders of society interesting themselves in his proposals for establishing suburban villas and residential farms. The following are the advantages claimed for residential farms:—

ADVANTAGES AND REMARKS.

Saving in time.—It is a fact that, in many instances, men and cattle have frequently to travel several miles to their fields in the morning, and the same distance back in the evening. In this way much time is squandered, and the coolest portions of the day are lost to agriculture.

Saving in labour.—It stands to reason that much vital force, otherwise available for the labours of the field, is expended on the mere journeyings to and fro.

Saving in wear and tear.—The agricultural implement would be kept on the farm, instead of being dragged backwards and forwards.

Preservation of health.—The general health of the cultivators, their families, and their cattle would be greatly improved by the free open air of the country. And, in like manner, the townspeople would be benefitted by the fact of flocks and herds being housed for the night *outside* instead of *inside* the town.

Preservation and local utilisation of manure—both solid and liquid.—This a most important point, as will be acknowledged by all practical agriculturists.

Better protection of the crops.—The farmer and his family residing in the very midst of their fields, a view of which would be obtainable from their own house-door, it is clear that the crops would be better protected than if left to take care of themselves so much.

The necessity of fencing.—This would also greatly assist in the matter of protecting the crops.

Prevention of accidents.—The coming and going of herds being stopped, would reduce to a minimum the number of accidents which now and then occur in densely-populated towns.

Prevention of waste.—This is too obvious to require any special remark.

Estates would be consolidated.—It is a common custom at present for one man to cultivate distinct plots of land far distant from each other. A compact farm would obviate the waste resulting from such a custom.

Estates would be within reasonable control.—There is no disputing the fact that one of the most crying evils of the present day is that cultivators are allowed to take up more, *much more*, land than they can properly manage. The amount shown in the plan accompanying would be quite sufficient for a single cultivator with his family, and would conduce to a higher or improved description of farming.

The moral tone of the people would be raised.—The spirit of freedom would undoubtedly be encouraged, and the love of "hearths and homes" fostered.

Major Nutt does not propose to take a resident in a certain town or village and suddenly transplant him, his family, and agricultural possession's to some out-of-the-way "jungly" place. What I propose doing, he says, in the first instance is simply to invite any individuals so disposed to occupy and cultivate suitably sized farms or holdings in close proximity to their native town or village—within a stone's throw, so to speak, of their present place of residence—so that their connection with their friends, the money-lenders, the grain-dealers, the potters, the carpenters and others, would not be interrupted in the slightest degree, but continued as heretofore. In this way personal security would also be provided for, as the town or village police would at all times be within call. Another objection which is of the same nature as the above as regards the idea of this agricultural change being instituted at once, and in all places, was that the nature of the land tenure and payment of revenue would be necessarily altered, to the derangement of existing custom. Well, all that need be said on this point is, that whereas the experiment is only proposed in a very small way to begin with, no derangement to speak of, in existing tenures, need take place at all.

I would commence operations in the immediate neighbourhood of towns and big villages, granting sites with frontage on a public road.

The holdings should not be too large, say not exceed 20 or at most 25 acres, of good culturable land, with a substantial house for a cultivator and his family, and suitable out-buildings for his cattle, implements, and general husbandry stock, including a commodious room or barn for storing grain. The house should be situated in the centre of the property.

A good well should be sunk close to the house. And a stout fence, planted with trees, should surround the estate, which would be approached from the public road.

Plans and estimates are attached, from which it will be gathered at a glance how I would propose to lay out each farm.

AGRICULTURAL BANKS &c.

WE have received from Mr. A. P. Webbe a pamphlet on Agricultural Banks and supplemental legislation for agricultural relief. Mr. Webbe's suggestions are comprised in the following summary:—

(1) Agricultural Banks to be officially initiated and worked—and subsequently transferred to private agency under due safeguards.

(2) Loans to be granted to the *proprietary, only on the "Floating Cash Credit" system*, which will harmonise with the practice of the village usurer, and therefore fit in sympathetically with the wishes and requirements of the agriculturist—with this radical difference, however, that a fixed or *maximum sum of indebtedness* only will be permitted the agriculturist.

(3) Only land and houses are to be mortgaged to the Bank. Sureties, one or more, with or without collateral security as the case may appear to demand.

(4) Amount of loan (or "Floating Cash Credit") to be determined by marketable value of property or actuarial value of rent or income from the same. Substantial sureties to augment the amount of loan.

(5) Interest not to exceed 9 per cent per annum, and to be graduated to the extent of the property mortgaged. So that small proprietors too might be accommodated with cheap loans.

(6) Amount of loan and interest thereon to be *officially* determined.

(7) Loans to be granted without formal mortgage, and without fees and other incidental expenses.

(8) Form of application for loans to be *officially* prescribed; detailing number and area of fields, character and extent of buildings, mortgage, lien, &c., on them, and their approximate valuation. These, to the extent *officially* tested and verified, to constitute the mortgage deed and the basis of the loan.

(9) The position of *first* mortgagee to be purchased, if practicable, and the amount so paid to constitute part of the "Floating Cash Credit" authorised.

(10) No *second* mortgagees to be permitted *after* the Bank has purchased the position of *first* mortgagee. Where the position of *first* mortgagee cannot be purchased, or where there should already be a *second* mortgagee, no loan to be authorised.

(11) Debts to be recovered *officially* for Banks and at their cost as if they were "arrears of land revenue."

(12) "Floating Cash Credits" to be granted similarly to the *tenantry*, on two or more proprietary or other good sureties; and similarly recoverable from the sureties, as if they were "arrears of land revenue."

The scheme of supplemental legislation includes such points as the follows:—

(1) State demand to be fixed for a term of 30 years, at 33⅓ per cent of proprietor's rental *exclusive* of cesses; instead of 55 per cent *inclusive* of cesses as now (See 3.)

(2) All tenant right, as now understood, to be abolished.

(3) Rent to be fixed by settlement officer at periodical revision of settlement.

(4) Rent subject only to following enhancements under authority;

(*a*) Enhancement 15 years after revision of Land Settlement, up to one-sixth of rent fixed at such land settlement; *when* value of produce has augmented through rise in market prices.

(*b*) Enhancement, when land has been improved by or made generally valuable at cost of proprietor.

(5) State not to share in such enhancement.

(6) Rents subsisting for 15 years or since last settlement to be now enhanced on the basis of (4) *a*; and those that have been since enhanced more or less, to remain unaltered till next settlement, unless proprietor has improved (4) *b*.

(7) Land brought under cultivation after revision of land settlement not to be subject to State demand or enhancement till ensuing settlement.

(8) But tenants on such land to hold at settlement rates for like class of land *plus* an additional charge *if* superior to such land in locality. Tenant and proprietor may come to agreement and record the same in the Revenue Courts—rent to hold good till next settlement, unless as (4) *b*.

(9) Crops to be held hypothecated to proprietor as now.

(10) Tenant to compensate proprietor for injury to land.

(11) Tenant to be evicted under court sanction *only for non-payment of rent*. But to be compensated for unexhausted improvements. When any.

12) Succeeding tenant, when any, whatever the interval of non-cultivation, shall pay only the same rent as the tenant evicted; unless as per (4) *a* and *b*, (8) and (17) involving outlay by proprietor.

(13) Rent to be abated when land is deteriorated or area diminished through causes beyond tenant's control.

(14) Tenant can vacate without consent of proprietor.

(15) But 6 months' notice to be given proprietor, or 6 months' rent paid him without notice.

(16) Tenants to vacate at 12 months' notice when land is required by proprietor—or to be compensated with one year's rent.

Notice to be served through Revenue authorities in all cases.

(17) Evicted and vacating tenants (11) (14) and (16) to be compensated for unexhausted improvements.

(18) No sub-division of estates to plots below 15 acres to be permitted. Eldest surviving male or female relative or child to inherit.

(19) Consolidation of dismembered estates into plots of 15 acres each to be effected gradually as present holder die off. Eldest male or female relative inheriting.

(20) Portion of *tenant's holdings* not to fall below 15 acres. Eldest surviving male or female relative or child inheriting.

(21) Consolidation of *tenant's holdings* into areas of 15 acres each to be effected on demise of present holders. Eldest surviving male or female relative to inherit.

(22) Revenue Department to possess complete jurisdiction in all matters. Revenue Board to be final court of appeal. All proceedings in consolidation of estates and tenants' holdings, to involve no cost to the parties concerned. Nor in the resumption of estates by cultivating proprietors (See 16 and 17.)

Mr. Webb contends and illustrates by instances that all tenant-right which makes the tenant a fixture, tends to the practical dispossessment and ruin of the peasant proprietary and small land-holders whose numbers are annually increasing. It also tends to the exclusion of capital, and ultimately pauperises the tenants.

The subjects dealt with are carefully thought out and elaborated, and the pamphlet forms a very noteworthy addition to the literature of the problems dealt with.

THE CATALPA: A VALUABLE TREE.

SOME time ago, Sir John O'Shanassy called attention, in the Legislative Assembly, to a celebrated American timber tree called *Catalpa speciosa*. The Ministers of Lands and Agriculture moved in the matter, with a view to procuring information, and have received reports from Mr. Guilfoyle, the Director of the Botanic Gardens, and Mr. Ferguson, Inspector of State Forests. Mr. Guilfoyle reports on the 27th November 1882, that the tree is said by many horticulturists and botanists in America, where it is indigenous, to be one of the most valuable timber trees known. One writer, Mr. C. H. Miller, of Fairmount Park, Philadelphia, says:—"There is a fine grove of catalpa in the park, some of them very large, one measuring 13ft. in circumference." A Mr. Arthur Bryant, of Princeton, Illinois, is said to have in his grounds a catalpa of the *speciosa* variety raised, from seed in 1839, which measured in 1879 (stump high) 3ft. in diameter. Other of the trees in South-Eastern Missouri measured in 1866, 3ft. and 4ft. in diameter, and 50ft. to a limb. In Indiana the trees reached a diameter of 4½ft. From one tree a limb was cut off 45ft. from the stump, a section of which was 8ft. long and 12½in. in diameter at the small end. A Mr. Barney, of Ohio, reported that a catalpa gate-post had been taken up, after being 46 years in the ground, and was found as sound as on the day it was set, no signs of decay being visible. Catalpa timber used in a stockade in Indiana had been found perfectly sound after being nearly 100 years in the ground. Similar particulars are given as to other pieces of this timber which have remained sound after being in use about 100 years. One log, after lying across a stream nearly 100 years, was cut into perfectly sound boards. Professor John Collet states that the timber is universally accredited with wonderful power to resist decay and time, and that after diligent inquiry, he had found no one willing to say the timber was liable to rot. Another writer stated that no decayed catalpa logs were ever found in swamps. The tree throve in France and Germany, and in protected positions in the South of England. It grows rapidly, and the wood is remarkably light, fine in texture, and capable of receiving a brilliant polish. The bark was said to be tonic, stimulant, and antiseptic. The tree can be readily raised from seeds, and cuttings, and in this climate the seeds should be sown in September or October, and the cuttings planted out of doors in March or April. The tree has been of rather slow growth in the Botanic Gardens, the largest specimen, although upwards of 18 years old, being only about 10ft. or 12ft. high. That tardy growth was doubtless due in a great measure to the poverty of the soil. The tree would not bear much exposure to strong winds, and delighted in a loose and tolerably good soil. The present stock of young plants in the gardens, numbering some 30 or 40, averaged from 1ft. to 2ft. in height, and were raised from seed supplied by Sir John O'Shanassy.

Subjoined is Mr. Ferguson's report:—

"STATE NURSERY, MACEDON, Nov. 27, 1882.

"SIR,—I have the honour to acknowlege the receipt of your letter of the 24th instant, *re* catalpa tree (*speciosa*.)

"I have the honour to report that I received from the late Secretary for Agriculture, in 1880, a package of seed of the above tree, and beg to inform the honourable the Minister of Lands that I have here about 1,500 plants that have been transplanted into nursery rows, most of which will be fit for planting out permanently in the forest during the coming autumn and winter.

"The *Catalpa speciosa* is a native of the Southern States of North America, where it grows to a moderate-sized tree, seldom being met with more than 60ft. in height, with a medium trunk. When in flower it is a grand sight and like its congener, *Catalpa bignonioides*, of our gardens, is much admired for its large foliage and beautiful flowers.

"The timber of *speciosa* is much sought after in America for piles and posts for fencing, and has been found to last for many years when subjected to damp and marshy places, where other kinds of timber have perished.

"Since its introduction to this colony, I find it to be a tree of rapid growth, well suited for a dry country, and I have no doubt when it becomes better known it will be extensively planted.

"About 250 trees were raised in the State nursery at Longerenong in the Wimmera district, and during last season I had them transplanted into nursery lines, and they are growing rapidly.

"The *Catalpa speciosa*, like the *Paulownia*, walnut, ash and other deciduous trees in this locality, are liable to get cut up by spring frosts, and I intend next season to make a permanent plantation of the catalpa in some more suitable locality in the State forests.

"I have &c.,
"W. FERGUSON,
"Inspector of State Forests.

"TO A. MORRAH, Esq., Secretary for Lands, Melbourne."

OFFICIAL PAPER.

BEE-KEEPING IN INDIA.

(Continued from Page 55, Vol. VIII.)

Tabular Information.

Tamil Names of Bees.	The Color, Size, &c., of the Bees.		Habit.			Yield of a Comb.		
	Color.	Size.	Whether they always remain in one locality, if so, how long.	1. Do they migrate; if so, 2. Why or when. 3. And whereto.	Do they swarm, and when.	Average Size of Comb	Quantity of Honey to be obtained from each Comb.	What proportion of a Comb is occupied with Honey, Bee breed, and Breeding locality.
1	2	3	4	5	6	7	8	9
1. Komban thain Yee or Malan thain Yee.	Body black, stomach red.	About 1 inch in length.	They are said to remain in one locality for some four months (Chitrary to the end of Adi), April to the end of July.	1. Yes. 2. When flowers are scarce. 3. Where they go to not known.	In April (Chitrary Masem).	About 1½ feet wide by 1½ feet deep by 6 inches thick.	At a guess 4 measures or 3 Madras seers.	1. About 6 inches in depth by honey. 2. About 3 inches in depth by bee-breed. 3. About 9 inches in depth by the breeding locality.
2. Sippan thain Yee.	Do.	About ¾ inch in length.	Are said to remain always on the hills, and for two months at a time in one place and to form a comb, store honey, and breed wherever they migrate to.	1. Yes. 2. When flowers are scarce. 3. When they have eaten all the honey, or if robbed they go a distance of a few miles.	Whenever they arrive at a new place after quitting the old.	About 6 inches wide by 6 inches deep by about 2 inches thick.	At a guess ¼ of a measure or 3/16 Madras seer.	1. About 2 inches in depth by honey. 2. About 1 inch in depth by bee-breed. 3. About 3 inches in depth by breeding locality.
3. Karan Thedavai or Ponthu thain Yee.	Do.	The size of a domestic fly or about ⅜ inch.	Are said to remain year after year on the hills and remain for two months in one place if not disturbed. They form a fresh comb, store honey, and breed wherever they go.	1. Yes. 2. When flowers are scarce. 3. When they have eaten all the honey, or if robbed they go a distance of a few miles.	Do.	About 6 inches wide by 18 inches deep by about 3 inches thick	At a guess 2 measures or 1½ Madras seers.	1. About 6 inches in depth by honey. 2. About 3 inches in depth by bee-breed. 3. About 9 inches in depth by breeding locality.
4. Santhoduvai thain Yee.	Do.	The size of a domestic fly or about ⅜ inch.	Do.	1. Yes. 2. When flowers are scarce. 3. When they have eaten all the honey, or if robbed they go a distance of a few miles.	Do.	About 6 inches wide by 18 inches deep by about 3 inches thick.	At a guess 2 measures or 1½ Madras seers.	1. About 6 inches in depth by honey. 2. About 3 inches in depth by bee-breed. 3. About 9 inches in depth by breeding locality.
5. Kosuvan thain Yee.	The body is black and the stomach of a light brown color.	About ½ inch in length.	Appear to remain in the same place year after year if not disturbed.	1. No; only when their number becomes excessive or are disturbed.	All the year round.	The combs apparently are suited to the size of the hollows, which are said to be deep and very narrow, generally about 2 inches wide by 6 inches deep by 2 inches thick.	At a guess ⅛ measure or 3/32 Madras seer.	1. About 2 inches in depth by honey. 2. About 2 inches in depth by bee-breed. 3. About 2 inches in depth by breeding locality.

Tabular Information—(Continued).

Tamil Names of Bees.	YIELD OF A COMB—(*Continued*).		HABITAT.			MODE OF HARVESTING.	MISCELLANEOUS.		
	What proportion of a comb is Wax and what refuse.	From what Flowers is Honey mostly obtained.	High or Low Elevation.	On Rocks or Trees.	In Holes of Rocks, Walls, Banks or Trees.	How is the Comb obtained.	Which bees might be domesticated.	Is there a Head or Queen Bee.	Is the sting venemous or painful.
	10	11	12	13	14	15	16	17	18
1. Komban thain Yee or Malan thain Yee.	About one-third wax and two-thirds refuse.	From the flowers of all trees, shrubs and the "Ooringee" shrub when in blossom, which is only once in about seven years.	At all elevations, high or low.	Precipitous rocks and high trees.	..	*Always at nights* are driven away by smoke from a torch: very few are burnt. No covering is used by the collectors, but on their return to the plains they bathe themselves with the water in which bruised tamarind leaves have been boiled in the proportion of quarter measure of leaves to one of water, which is said to remove all swelling and pain caused by any stings.	The Komban thain Yee would not succeed.	Not known.	Is painful and causes much swelling, which lasts about two or three days, and the pain for a day only.
2. Sippan thain Yee.	Do.	All trees and shrubs.	Lowish, say, 1,000 feet above the sea. Not in forest.	Thick shrubs.	..	Smoking is not employed, but the leaves of the "Shiri Shenni Chedi" or plant is made into powder which is blown on to them, and the smell of the leaves is said to drive them away. No covering is used by the persons removing the comb.	Sippen Yee. This would not succeed.	Do.	Is painful for about two hours and the swelling is not much, and lasts for about two hours only.
3. Karun Thoduvai or Ponthu thain Yee.	Do.	Do.	Always in sholas and cool places or high elevations.	...	In moderate-sized holes in rocks and trees and snake-holes.	Are removed in the day time by simply blowing them away. No smoking or anything else is employed. They are said not to sting.	Karun Thoduvai Yee. This bee might possibly be domesticated.	Do.	.
4. Senthoduvai thain Yee.	Do.	Do.	In grass lands and open forest.	..	Do.	Do.	Do.	Do.	..
5. Kossuvan thain Yee.	About four-fifths wax and one-fifth refuse.	Shrubs and small plants, generally along channels, water-courses and rivers.	Low and in the plains.	...	In small holes, in walls, banks or trees, and snake holes.	These combs are removed without the aid of any smoke or covering, as the bees do not sting but only cling around one.	Kossuvan Yee.	Do.	

Tabular Information—(Continued).

Tamil Names of Bees.	Miscellaneous—(*Continued*).							
	How do the Bees extract the Honey, and convey it away to the Comb.	How is the honey extracted from the Comb.	In which month of the year is Honey formed, and which are the chief months.	Is Honey put through any process to preserve it for a length of time.	For what purpose is Honey used.	Is the Honey of any one species of Bee sweeter or more bitter than another.	What Color is the Honey.	How is the Wax separated from the Comb and purified.
	19	20	21	22	23	24	25	26
1. Komban thain Yee or Malan thain Yee.	The honey is removed by the legs and conveyed away thus.	The primitive method is to squeeze it out with the hand. In the Tinnevelly Division, however, a magnified lime-squeezer has been introduced by the Forest Department for separating the honey from the wax, to overcome the filthy practice of squeezing with the hand. Sometimes it is said to be squeezed through a cumbly twisted round and round tightly.	Between beginning of May and end of July. Honey chiefly formed in June and July.	Some say it should be kept in *new* earthen pots as they absorb all watery matter. A little wax is left in the honey in the proportion of ½ a pollum to every measure of honey. Others say honey is preserved by boiling it until all scum or froth ceases to rise. This thickens the honey, which is said prevents it from fermenting.	As food; medicinally; as a preserve for fruit and ginger; for anointing the gods in the temples.	This is regulated by the flowers from which the honey is obtained.	Newly formed honey is yellow, but after it has matured a little, it turns a darker color.	After the honey has all been squeezed out of the comb, the latter is thrown into a pot of water which is put over a fire until the water boils, after which it is allowed to simmer, during which time the contents are ladled out with a cocoanut spoon a portion at a time and placed in a strong cloth, which is twisted round and round by two persons at both ends over another pot of cold water thus causing the wax to escape through the cloth and fall into the water below. This process separates the dross from the wax. After this the wax has to be boiled again to clarify it, and when in the boiling state it is in the primitive way, poured into a round hole dug in the ground which is plastered with mud. After some 3 or 4 hours, when the wax has had time to congeal and become hard, it is removed out of the hole, and the surface of the wax is scraped until dross has been removed. A quicker method of obtaining the wax and causing it to congeal is to sprinkle cold water into the pot containing the liquid wax; this makes it congeal in layers, which is removed with a cocoanut spoon, and the process of sprinkling repeated until the whole has congealed, which method occupies only a short time according to the quantity of wax in hand.
2. Sippan thain Yee.			All the year round, but in June and July most honey is formed.					
3. Karun Thoduvai or Ponthu thain Yee.			Do.					
4. Senthoduvai thain Yee.			Do.					
5. Kosuvan thain Yee.			All the year round.					

Mr. H. Sewell, Collector of Trichinopoly, writes regarding the Pachaimalai Hills :—

Wild bees are found in this district, chiefly on the Pachaimalai Hills. There are three varieties of them, *viz.*, the Kathandai, the Porai, and the Siru or mosquito bee.

The first (Kathandai) is the largest bee, being about an inch in length and half an inch in diameter. Its sting is very painful, and sometimes results in death. These bees build their nests in crevices of rocks. To collect the honey a man is let down in a basket or a ladder fastened to a rope. He kindles a fire underneath the hive, which either stifles or drives away the bees, and then collects the honey in gourds slung round his waist. The nests, which are sometimes as large as 2 × 2 × ½ yard, are said to contain from 4 to 12 Madras measures of honey each, a measure weighing 4½ lb.

The second variety is about half an inch in length. It has a sting, but it is less painful than that of the first kind, and not at all dangerous. It builds its nests generally in hollow trunks of trees or on their boughs. The nests are comparatively small. They yield from 1 to 4 measures of honey each. There is no difficulty in collecting this honey. The bees can be driven away by holding a torch under the hive or by striking the comb with a stick.

The third and last kind is the mosquito bee. It is about twice the size of an ordinary mosquito, and is inoffensive. It builds on trees and in the eaves of houses. The nests are very small, and yield only from 1/16 to ½ measure each.

No reliable information is available as to the quantity of honey produced in the district. The Sub-Assistant Conservator of Forests gives it as 350 Madras measures a year for the whole of the Pachaimalai Hills, while the head Assistant Collector puts it down as 800 measures for his side of the Pachaimalais. I think 500 measures may fairly be taken as the annual yield. The hill people sell their honey at about 8 annas a measure, and it is re-sold in the bazaars at about a rupee a measure. It is chiefly used for medicinal purposes. It also serves as food on festive occasions, being mixed with fruits, &c.

There is no honey exported from this district. On the other hand, it is said to be brought here for sale from Madura and other districts.

The first or the Kathandai variety is not in my opinion capable of being domesticated. The second and third kinds, which are found not only on the hills but also in the plains might, I think, be domesticated. But I doubt whether the natives could be easily persuaded to take to bee-keeping as is done in European countries. The demand for honey in these parts is not great, and the juice of sugar-cane, which is abundant, supplies the place of honey as far as the sweetening of food is concerned. They have, moreover, a prejudice against bees, and they consider it unlucky to have them near their houses. Probably the prejudice arises from the natural dislike to being stung.

The following extract is from a letter from the Temporary Deputy Collector of North Arcot to the Collector :—

In both the talooks (Chittoor and Candragiri) of my division bees are not domesticated, and honey is taken from wild bees only. There are four varieties of bees, *viz.*—

(1) Pedda Eaga (large bee, which is of black color).
(2) Pulla Teneega (dun-colored bee).
(3) Thorra Teneega (bee which hives in the hollows of trees.)
(4) Masara Eaga (grey-colored bee).

The first or the Pedda Eaga hives on the tops of hills; the second (Pulla Teneega) on the boughs of trees; the third (Thorra Teneega) in the hollows of trees and in the clefts of rocks; and the fourth (Masara Eaga) in the hollow of trees, in walls, and in the clefts of rocks; bees make their hives during May, June and July. Honey is extracted from the hives of the bees of the second, third, and fourth descriptions by the process of smoking. The hives of the bee called Pedda Eaga, which are made on the tops of hills, are generally inaccessible, except to the skilled *Erulas* (hill people) who extract honey from them by means of ladders and smoke. A bamboo ladder is let down, fastened to a peg on the top of the hill, and by means of this ladder one of the Erulas gets to the hive and extracts the honey, while others, from below, drive the bees by means of smoke from a lighted bundle of thatching grass. The man covers himself with cumbly to avoid the sting of the bees. No information is available as to what distinction there is between the bees here and in the cold climates.

With the exception of the Masara Eaga, the other classes of bees do not remain permanently in one place. The sting of the Pulla and Thorra Teneega is not villainous, while the Masara Eaga does not generally sting. In the case of the Pedda Eaga, unless about 10 or 20 of them collectively sting there is no danger.

The quantity of honey produced annually in the jungles of the Chittoor Talook is estimated at about 4 maunds, while that produced in the Chamala and Panapakam Forests of the Chandragiri Taluk is estimated at 10 maunds. Each hive does not produce more than 2 pollums of honey. The price of a maund of honey is between Rs. 2 and 2-8-0.

About 3 or 4 maunds of honey is annually exported from the Chandragiri Taluk to Nellore, Madras, and Kumbakonam, and the rest is locally consumed for medicinal purposes. When no honey is available here, it is sent for from Madras in small quantities. Honey is not usually consumed as an article of food.

Mr. Stuart, Acting Collector of North Arcot, also forwards a precis of reports received from Divisional Officers and Tahsildars, which may be found useful. It is therefore appended :—

I. General Duties Deputy Collector.

(A.) *Talooks of Polur and Wandiwash and Arni Division.*—Only a small quantity of honey is produced in this division. It is sold in the local markets at 6 annas a viss. There is no exportation, the local supply being barely sufficient for the demand. There is, however, no importation.

(B.) There is no domestication of bees in this division.

There are four kinds of bees in this division. Their stings are very dangerous, and the honey can only be obtained by the Irulars, a wild jungle tribe. Their method of doing this is to strike the comb with a stone or spear, whereupon the honey runs out into pots previously placed underneath.

(C.) Of the bees found here, three kinds are very wild, and any attempt to domesticate would only prove fruitless. The fourth kind, however, called from its small size the Mosquito Bee, which builds its hive in ruined houses and the hollows of trees, might be domesticated with a little care. The quantity of honey in a hive of these bees is very small, and is sour to the taste, owing to the bees gathering it from the flowers of the margosa and mango trees. It is often given to children in the belief that it will make them able to talk at a much earlier age than usual.

II. The Temporary Deputy Collector.

(A.) *Talooks of Chittoor and Chandragiri and Tirupati Division.*—The Chittoor jungles produce about 4 maunds, and the forests of Chamala and Panapakam, in Chandragiri Talook, about 10 maunds of honey per year. The price varies between Rs. 2 and 2-8-0 per maund. About 4 maunds are annually exported from Chandragiri to Nellore, Madras, and Kumbakonam. The remainder is consumed locally for medicinal purposes, and occasionally as an article of food. Small quantities of honey are brought from Madras when the local supply is exhausted.

(B.) There are four varieties of bees in this division, but none of them are domesticated.

(1). *Pedda Eaga.*—These bees build their hives on the tops of high rocky hills. The jungle tribes extract the honey from the combs in the following manner: A bamboo ladder is fastened to a peg on the top of the hill and let down the cliff on which the hive is built. One man descends this ladder and gathers the honey, while others below drive out the bees by smoking them. There is no danger from their sting unless 10 or 20 of them attack at the same time. These bees do not hive permanently in one place.

(2.) *Pulla Teneega*, a dun-colored bee, which hives on the boughs of trees in May, June, and July. The honey is obtained by the smoking process. Like the above, they do not remain permanently in any one place. Their sting is harmless.

(3.) *Thorra Teneega.*—These bees hive in the clefts of rocks and the hollows of trees in the months of May, June, and July, and the honey is extracted by the smoking process. They do hive continually in the same place. Their sting is harmless.

(4.) *Masara Eaga or Grey-colored Bee.*—They build their hives in the hollows of trees in the months of May, June, and July. The honey is extracted by the smoking process, and, as a rule, the bees do not sting. These, unlike the foregoing varieties, generally continue season after season to hive in the same place.

(C.) There are no bees in this division likely to prove valuable if domesticated.

III. The Deputy Tahsildar of Punganur.

(A.) *Punganur Division.*—About 50 maunds of honey are obtained yearly from the jungles of Avulpully and Kilapatla in this zemindari. It is sold at Rs. 2 per maund, and the supply is sufficient only for local requirements.

(B.) There are five kinds of wild bees found in this division.

(1.) *Para Teneega.*—This species, which is the largest found, hives on high and inaccessible rocks. The yield of a hive, which consists on an average of four combs, varies from 2 to 4 Madras measures, the Irulars driving the bees from the hive by smoking them. Their sting is very painful, and has occasionally proved fatal.

(2.) *Thala Teneega or Putta Teneega.*—This species build their combs in the hollow trunks of trees, crevices of rocks, ant-hills, and the walls of uninhabited houses, if flowers and water are sufficiently near. This bee is of a reddish black color. The yield of a hive varies from 1 to 4 Madras measures. The bees can be driven out and the honey taken by merely shaking the hive.

(3.) *Komma Teneega* or (2) *Junti Teneega.*—These bees hive in bushes and on the branches of trees. It has a black head with a grey body and wings. Only one comb is built, and the yield, therefore, is only about a quarter of that of the Thala Teneega. What it lacks in quantity, however, is made up for by the superior quality of the honey, which is the sweetest, clearest, and thickest of all.

(4.) *Jitta Teneega.*—This is the next in size. It hives in bushes and on the branches of trees. The honey is good, but the yield is so small that it is not worth the trouble of collecting.

(5.) *Musara Teneega.*—This is the smallest in size and resembles a mosquito. It builds its hive in walls, under stoves, and in small holes in trees. The honey is very sour to the taste, and the yield is very small. The wax alone is collected.

IV. The Deputy Tahsildar of Kangundi.

(A.) Considerable quantities of honey and wax are obtained from the jungles near the villages of Kangundi, Noolagunta, Adivi, Boodugur, and Chadumoor. The season when the bees are most active is during the south-west monsoon, from May to August. The best honey is that made from the flowers of the Pacchala, Yerracheekie, and Veppala trees; that gathered from other wild flowers is much inferior in flavour. The yield of the whole division is now only about 50 maunds. Prior to the present reckless felling of his forests by the zemindar, the yield was about 100 maunds. If this system of felling continues, it is to be feared that honey will cease to be produced at all in this division. The local price is from Rs. 1-8-0 to Rs. 2 per maund, but in Madras and Bangalore, to which places a considerable quantity is annually exported, about double that price can be obtained. Much of this

exported honey, however, consists really of honey and jaggery. The honey is separated from the wax either by simply squeezing the mixture in a cloth or by mixing it with water. The honey is then boiled to prevent its going bad.

(B.) There are four kinds of bees found in this division.

(1.) *Konda Tenega*, a black bee almost an inch long. They build their hives in the crevices of rocks. The yield of honey from a comb varies from 2 to 4 full measures, and is of very good quality. The honey is collected from the hive by the ordinary smoking process. The sting of this species is very painful, and has been known to cause death.

(2.) *Thoduga Baga* or *Thorra Baga*, a bee of ½ to ¾ an inch in length, and of a red and black color. These bees build their combs in the crevices in the trunks of trees. The yield varies from ½ to 1 measure, and the honey is much superior to that of the last-mentioned species in sweetness and flavour, but is inferior in solidity and clearness. The mode of taking the honey is very simple: the bees are driven out by striking the hive with a light switch, and the comb can then be taken with safety.

(3.) *Komma Baga*. These build their combs on the branches of trees, and excel all others in the sweetness and fragrance of their honey. The yield varies from ½ to 1 measure, and the honey is collected from the hive in the same way as that of the last-mentioned species.

(4.) *Kosura Baga*.—These build their combs on the eaves of houses, and sometimes on small boughs. The honey is of a very inferior quality, and the yield is less than a quarter of a measure.

(C.) Bees are not domesticated in this division, and there appears no probability of their being so.

V. The Tahsildar of Vellore.

(A.) No information given.

(B.) There are seven kinds of bees found in this talook.

(1.) *Periya Theni*.—These build their hives on high rocky hills, and will attack trespassers very fiercely. The bees are smoked out and the honey then taken.

(2.) *Kurumbi Theni*.—These build their combs on the big branches of trees. The honey is obtained by the smoking process.

(3.) *Thoduga Theni*.—These hive in the hollows of trees; they will sting if provoked; and the honey is collected by the smoking process.

(4.) *Kombu Theni*.—Build their combs on small branches of trees.

(5.) *Kosu Theni*.—Hives on walls.

(6.) *Chittai Theni*.—Hives on bushes.

(7.) *Kappu Theni*.—Hives on maize crops.

(C.) Bees are not domesticated in this talook.

The above extracts exhibit the principal information that the Board have been able to obtain.

R. SEWELL,
Acting Sub-Secretary.

SELECTIONS.

INDIAN TEA.

(Continued from page 60, Vol. VIII.)

(Continued from page 60, Vol. VIII.)

Picking.

THE sap begins to rise in March, and by the middle of April the first flush or picking comes on, and every available man, woman, and child in the neighbouring villages is hunted up to reinforce the permanent coolies of the establishment. A man and a boy per acre are required for a garden in full yield, at Rs. 4, Rs. 3, or Rs. 3-8, a month respectively. On a garden of 600 acres there would, therefore, at times be the responsibility of 1,000 coolies on the head of one European, who has himself only to rely upon for good management and efficient work. The flushes continue in greater or less strength and vigour from April to the end of October. A long, succulent shoot runs up of four, five, or even six leaves, and from these three or four are taken as the case may be; the whole shoot, stem and leaves, is picked off by the fingers down to the leaf which is left to shelter the bud from which the new flush is to spring. At times the growth is so rapid that by the time the pluckers have been round the whole garden in the course of two or three weeks, and have, with their nimble little fingers of both hands at work at the same time, taken off all shoots that are then ready for plucking, new shoots have come to perfection. It is astonishing how few mistakes these pluckers make; they become such adepts at the work that it is very seldom that too few or too many ready leaves are picked from any particular shoot.

Preparation of the Leaf.

During a good flush some 5,000lb a day of leaf will be plucked on the plantation, and when it is brought to the factory, if it be intended to make black tea from it, must all be spread out in thin layers to wither. The planter's ingenuity, after all his floors and tables are covered, is much exercised to contrive surface for this necessary process. High racks are constructed, and divided by thin slips of wood or wire, so as to form lofty stands for series of light bamboo trays, which contain the leaf. In this way the air circulates among the bright, fresh green leaves, and what was life to them whilst they were on the bushes now brings decay, and by the following morning the day's picking is changed to a dark green colour, and the crisp leaves have become withered, soft, and pliable.

The rolling process, which follows next, is in some gardens carried out by machinery, and thereby much labour is saved, though perhaps not altogether to the benefit of the leaf. We will, therefore, keep to the old plan. A hundredweight of the withered leaf is given out to every three men, and if the leaf be succulent it will take them four or five hours to roll this properly: the work is hard and exhausting, and very often the men begin as early as 3 A.M. to get it well over before the great heat of the day comes on. Each man takes as much at a time as he can grasp and conveniently cover with his hands, then with arms and hands he gives a sort of rotatory movement to the leaf, which he presses with the palms and heels of his hand, and deftly gathers together with his fingers, working the mass so as to break all the cells of the leaf and free the sap, and at the same time to give it that curled and twisted form peculiar to manufactured tea. When sufficiently manipulated the mass leaves the hand in the shape of a ball, and is placed to ferment in baskets, which will hold about 2 cwt. each, lined and covered with damp blankets.

The amount of fermentation given to the leaf is a matter of great importance, and requires in its regulation much judgment and experience; the process can be checked or encouraged at the will of the planter, whose object is to produce a leaf of a bright colour, like a new penny, which is also the colour the finished tea should have after infusion.

When the proper amount of fermentation has been obtained, the balls of leaf are taken out of the basket, broken up, and thrown into metal pans, to be cooked over a gentle fire. This at once checks and stops the fermenting of the leaf, and makes it softer and more pliable for the second rolling, which is generally necessary at this stage. The leaf is from this time called "tea," but it would seem that it is not yet quite a finished article; for even after panning, the colour of the newly-manufactured tea is liable to change, becoming, as it is thought, oxidised by the action of the air. It is the planter's business to see that one process of manufacture succeeds another as quickly as possible, and immediately spreads the new tea on bamboo mats, or sheets of zinc, and places it in the hot sun, which quickly dries up into the tea all the remaining sap, fixes the twist, and adds a bloom like that on a dried raisin. To prevent the possibility of the tea becoming sour and any loss of aroma from exposure, it is, after a short exposure to the sun, taken to the long, narrow firing-rooms, which run along the side of the factory, and placed in wire-gauze trays, holding about 2lb each of tea, over charcoal fires, which are contained in long narrow troughs of masonry, about two feet high. Supposing 100lb of tea to be over the fires at one time in these 2lb trays, it would require an hour and-a-half to dry the tea sufficiently for packing, and as space is limited, the tea is usually fired to such an extent as will prevent its turning sour, and finished off afterwards.

Sorting for Market.

All that remains is to classify and sort the tea, and to pack it for market. A certain amount of classification has been going on during manufacture; and the larger and coarser tea can be separated from the mass by sifting it, but after that the tea has to be shaken out pound by pound on to bamboo trays, and sorted by the quick fingers of boys and girls, who, whilst they separate the various qualities of tea, pick out all useless and foreign matter. This is a long and tedious work, and, to the uninitiated, seems hopeless.

Each estate keeps its own sawyers, carpenters, and smiths, who cut the trees from the forest—which the planter should always be careful to include in his land purchases—saw the planks, and make the chests in which the tea is packed, and which, lined with sheet lead, are sent off to Calcutta or London. The season's tea is sent in as few consignments as possible, to secure uniformity of appearance and taste to the various "breaks."

Now comes the Indian tea-planter's great difficulty. He has laid out considerable capital in land, in planting, in cultivation, in manufacture. He has worked hard, honestly, and conscientiously to produce a genuine and pure article; and now he wishes to sell his production, which those best able to judge pronounce to be equal at least to the very best and purest teas grown in China; but the brokers tell him that these and inferior China teas have so long held the first place in the markets of England, and that the public have been so impressed with the notion that no other tea can bear comparison with them, that they have the greatest difficulty in procuring a fair trial for his tea. The Indian planter finds that the vast quantity of China tea which is annually imported into England, and the variety of quality and flavour which these teas possess, together with the facility afforded for mixing growths of various districts and different qualities of teas, so as to meet the taste of the English consumer, have vitiated that taste and rendered the pure, unadulterated, unmixed, and wholesome tea of the hills of India, an unknown, and, consequently, unappreciated, article in the English markets. It very soon becomes plain to him that his interests are sacrificed to those of the retail dealer; and thus, when teas of widely different value, of flavour, of season, and of growth are imported in enormous quantities, the temptation to mix them, so as to force the consumption of low-priced tea at such a price as should of right only be commanded by those of the best flavour and growth amongst them, is almost irresistible by mercantile morality.

As most of the Indian teas are of remarkable strength and flavour, they are largely bought, not to sell in their pure state, but to mix with greatly inferior teas; and in order to keep an open market for these mixed and adulterated teas, the public, in many instances, is allowed to believe that Indian teas are unfit for drinking in their pure state; and the Indian planter finds that this interested and persistent misrepresentation stands in the way of every honest attempt on his part to introduce to public notice an article second to none of the very best produce of China. As he is unwilling that his tea should be regarded only as an article for giving body and

flavour to inferior China teas, and as he believes his tea to be worthy of the very highest place in the public estimation, and that the people of England can only rarely, as things are, taste the tea of the Kangra and other hill districts, he has now determined to be, as far as possible, the salesman of his own produce. He is encouraged to do this because though the taste for Indian tea is shown to be increasing by the fact that so many dealers comparatively now profess to sell it, an Anglo-Indian on his return home very seldom finds that, even in these shops, he can get the same kind of tea as he drank with so much relish in India. It is only in some unknown slip of a shop, or a room, where little attempt at publicity is made, that he can buy the real article he wants, out of the chest in which it was originally packed, in the garden in which it grew.

The planter believes that if he comes himself to England, and offers the public the produce of his own garden in its pure unmixed state, he will soon run John Chinaman's mixed and artificially strengthened rubbish out of the market, secure his own interests, advance the prosperity of India, and speedily command from the English public that support to which all honest trade is entitled. He will be at hand to afford any information possible regarding the cultivation, manufacture, and sale of his produce, and if it be true, that from any cause the present system works neither for the advantage of the producer nor the consumer, it is only right and reasonable that he should use every proper and legitimate means to improve matter without being considered guilty of any unseemly or unfair competition with wholesale or retail tradesmen.—*Gardner's Chronicle.*

THE SUGAR INDUSTRY IN THE FAR EAST.

ONE of the most interesting branches of commercial history to trace is that of the growth of the sugar trade, from its first rude beginnings away back among the mists of time, down to its present enormous development all over the world—a development which last year in the United Kingdom alone, with a population of 35,300,000 souls, reached 989,208 tons, of sugar,—giving an individual consumption of 62·77 lbs.; and of molasses 12,672, tons, or ·80lbs. per head.

According to Dr. Mosley, the great authority on the history of the sugar industry, the first notices we have of sugar are from the pens of Pliny and Dioscorides, the latter a sort of army surgeon, who accompanied the Roman legions in the first century of our era. What their description simply amounts to is that it was a sort of concreted honey found upon canes in India, of the consistency of salt, and, like it, brittle between the teeth. It was used at Rome as a medicine. Now, as the art of refining sugar and of making loaf-sugar was not known until the end of the fifteenth century, it has been very naturally conjectured that the sugar referred to as being in use at Rome, is no other than the sugar-candy of one's boyhood, the art of making which has been known in China from a remote antiquity. It is further known that large quantities of this article have for many centuries been exported to India, and that from thence, small quantities were sent to Rome. As, at least, showing the wide diffusion of the article, we may mention that so late as forty years ago the beautiful white crystals of Chinese sugar-candy were used for domestic purposes, to the almost total exclusion of every other kind of sugar, by the Europeans at the different settlements of the East. Canton was not only a great tea and silk port, but, in possessing this monopoly, was, as times went, a great sugar port, the annual export amounting to the respectable figure of 10,000 tons.

It will thus be seen that the successful introduction of the sugar-refining industry into the colony had, if we may so put it, somewhat like a historical warrant to authorise its introduction; and in saying this we do not in any way detract from the credit of those bold spirits who worked so hard and lost so much in placing it on a workable basis. As Hong-Kong, since its cession, has gradually absorbed whatever of the Canton trade that did not go to the treaty ports, it is natural to expect that it should also have a share in its sugar export, and with its greater facilities more than take up the position that Canton once held as one of the principal centres of distribution of refined sugar for the East. With sugar-producing countries all round us, sugar ought to become a staple industry here. From the statistics published by the Inspector-General of Customs at Shanghai, and from other sources of information, we learn that the cultivation of the sugar-cane, and the rough and ready refining of sugar, is more than ever seriously engaging the attention of Chinese farmers and capitalists on the mainland; thus indicating that in spite of all drawbacks there incident to such an industry, it possesses within itself all the elements of success. The native appliances for crushing the cane are of the rudest construction, and are propelled by animal labour, usually from four to five small oxen. The juice, after being collected in a receptacle in the ground, which holds from twenty to thirty gallons, is removed by hand to the boiling pans. These boiling pans are made of cast-iron and are manufactured at Fatshan, near Canton. The principal varieties of sugar made are the candy, the green, and the clayed sugars, of which the first and last are largely exported. In all the three descriptions, the process seems to be tedious, uncertain, and wasteful, involving a vast amount of human and animal labour. The endeavour to get rid of such hampering conditions, together with a desire to have freedom from official interference, in a large measure explains the erection of the refinery by a Chinese Company at Bowrington, East Point. The machinery for this concern, we believe, is supplied by a well-known Greenock firm. It possesses the latest improvements, and has cost £50,000 sterling. We learn that, with the exceptions of the manager, engineer, and one or two others, it is entirely a Chinese speculation, and altogether under their control.

The causes which at present are militating so disastrously against sugar-refining in England and France, we imagine, will ultimately conduce to the prosperity of sugar-refining abroad, especially in the East. Germany and Austria, in particular, it is well known, are bolstering up at the expense of their ratepayers and of other industries, the manufacture of beetroot sugar, by a system of bounties utterly subversive of all principles of free or fair trade. The only remedy for this state of things, as far as can be seen at present, is the reduction of all intermediate profits by the transfer of all processes connected with refining to sugar-producing localities. If this is the remedy, and facts tend to show that it is, the consequence will be the removal of English capital to the sources of production; and it must be conceded that nowhere is there such a combination of advantages as are to be found in China and the Philippines. In the first place there exist all suitable conditions of climate and of soil, labour is cheap and abundant, refining from the cane is speedily and less expensively effected than from beet, &c., and no other sacchariferous plant surpasses the cane, in the purity of its juice, in its extraordinary vitality and in the prodigality of its yield, and last but not least the constant, almost daily, communication with the principal sugar-consuming countries by lines of steamers proceeding to both hemispheres.

That we have an undoubted advantage in possessing abundance of cheap labour is borne out by the fact that the sugar-producing countries of Hawaii, Demerara, the Mauritius, Cuba, Natal (and North Queensland, if we mistake not) have, all in turn and at immense expense, imported field hands from these shores. Even the introduction of Chinese labourers does not solve the difficulty; for the Chinaman who has a genius for retail shopkeeping, the moment he has capital enough, turns his back on all field work, and sets himself up in a store in the neighbouring village or nearest town. Nay, more; further complications await the planter and the mill-owner from the coolies they have introduced. Referring to the introduction of Chinese labour into Hawaii, Mr. Thrum of Honolulu remarks:—"The very large influx of Chinese during the early part of the year afforded no apparent relief to sugar and rice plantations in modifying the rates of wages, which have materially advanced since the workings of the treaty were entered upon, as they (the coolies) were found to be under sworn secret society obligations to maintain rates or figures found existing; and to secure sufficient to break such a monopoly would be to endanger our commercial relations and lose our autonomy." We may remark that, notwithstanding the troubles that afflict the Hawaiian sugar-planter, he has been doing very well. The sugar exported to the United States was calculated to be 45,250 tons—not a bad output for a group of mountainous islands of an area not much larger than Yorkshire."

From the troubles we have mentioned above, employers of labour in China and our neighbours in the Philippines are happily to a great extent exempt. The teeming millions of unskilled, badly-fed labourers render combination among this class next to an impossibility, and they are not adverse to emigration to the Philippines. Our local line of steamers render the expenses of specially chartering vessels for emigrants unnecessary; and the Spanish Government, if we know it at all, is not a Government to stand any nonsense from secret societies or trades-union obligations. When, in the present condition of sugar-growing and sugar-refining in the Philippines, we find that Manila sugar in the New York market competes to advantage with West India and Louisiana sugars and home sugar made from beet and other saccharine plants, it is a legitimate inference that with a still fuller development of the trade and with an ultimate reduction of expense consequent on the introduction of more economical methods of working, and as times goes on, we shall bid fair to command a wider and more profitable market. Let us take an instance. We quote from a number of the *Sugar Cane*:—The steamer *Malabar* some time since arrived in New York with a cargo of 2,325 tons of sugar. This is said to have been the first steamer that has ever come from the Philippine Islands to the United States, and she brings what is believed to be the largest cargo of sugar imported to the United States. The cargo was consigned to Messrs. Willett & Hamlin of New York, who have sold it for $360,000 to Messrs. Havemeyer and Elder, sugar refiners. The cargo will pay duty to the Government of about $125,000." We do not know and have not cared to enquire whether this particular cargo proved a profitable speculation or not, but it does not take much acuteness to read between the lines, and to perceive that, if the sugar had been refined in Manila, what a great amount of charges for freight, for commissions of all kinds, and perhaps, for duties, would have been saved.

We refer in this article to no concern in particular, nor have we any interest or bias in favor of any particular inspection; what we simply wish to point out is that there is a great future for the sugar industry in China and the Philippines—speaking generally. One point must not be omitted; it is an unquestionable fact that the use of sugar among the Chinese is rapidly increasing; it is ceasing to be a luxury, and is fast becoming an article of diet. With such a market at our doors, capable of almost indefinite expansion, there should be no room for hesitation; especially as the experience of the trade shows that whenever sugar has been introduced into a district, the demand is maintained. As for the sugar-bounties, we can afford to laugh at them, for no beet refineries, be they ever so liberally subsidized, can continue long to compete with the exceptional combination of resources that Nature has placed at our disposal, in a teeming and industrious population, in a fertile soil, and in tropical sun.—*China Mail.*

NILGIRI BOTANICAL GARDENS.

THE report on the progress and condition of the Government Botanical Garden and Parks on the Nilgiris for the year 1881-82, which was submitted by Mr. A. Jamieson, the Superintendent, in July 1882, has been published, with the remarks of Government thereon. The latter include the following:—"The

delay in the submission of this report, which was due on the 10th July, is noted with disapproval. In future the Collector should forward the Superintendent's report at once with any remarks he may have to make. An elaborate covering letter on a technical subject is wholly uncalled for." We read that "during the year under report, 377 fruit trees, 2,348 timber trees, 7,950 ornamental trees, shrubs and herbaceous plants, 2,317 packets of vegetable and flower seeds, 85 bouquets, and 141 baskets of cut-flowers were sold by the gardens. The gross income from the sale of seeds, plants, &c., from the several gardens was Rs. 3,026-10-4, and the expenditure Rs. 16,426." The growth of potatoes during the year has not been satisfactory, but the Superintendent has obtained some new and approved kinds from England which promise to do very well. He again calls the attention of planters and owners of cattle on the hills to prickly comfrey and Brome grass as fodder-producers. These fodder plants, he states, undoubtedly hold the first rank both as regards quantity and quality of their yield, and the ease with which they can be cultivated. A new fodder plant, tagasaste (*Cytisus proliferus*) has attracted Mr. Jamieson's attention, and he says that of all the plants with which he is acquainted, none seem to have taken more kindly to the soil and climate of the Nilgiris than this shrub. The plant would, he feels sure, be especially valuable in localities such as Kartary and Kalhatti, where grazing is year by year becoming scarcer. He has a quantity of seed and will be happy to give some to any one willing to give it a trial. Some interesting experiments with cinchona were tried. *Cinchona Carthagena* thrived very well, and the propagation of this valuable species has been so successful that a number of well-grown plants and cuttings were handed to the Overseer of the Dodabetta Plantation. And Sim's Park *Ledgeriana* did not succeed, owing to the soil being unfavourable. Here some foresight and a little thought might have prevented what proved a useless experiment. It is well known—or should be—what soil *Ledgeriana* will grow in, and surely the Superintendent knew what soil he had to deal with in Sim's Park? There is no lack of literature dealing with cinchona cultivation. Owen's Manual is one of the best works yet published, and besides that one there are King's Manual, Markham's "Peruvian Barks," Mr. J. Ferguson's essay, and others. What Mr. Jamieson prized most of the new plants introduced were the *Castilloa Elastica* plants obtained from Ceylon, and which he has no doubt will find a suitable home in Wynaad, where it will probably yield a profitable return to the cultivator. The black wattle appears to thrive very well in Ootacamund, and as the bark is valuable for tanning purposes, while the timber is of a superior quality, the Superintendent of the Botanical Gardens calls the attention of all who contemplate planting to this valuable tree. The cultivation of the wattle is simple and easy. Perhaps we may soon read what the Conservator of Forests says about wattle, as his opinion has been sought. Mr. Jamieson says of Liberian coffee:—

"This excellent coffee continues to grow luxuriantly and yields annually more abundant crops than the ordinary coffee growing alongside of it. The Native estate proprietors in and around Barliyar are now, I am glad to say, beginning to recognise its superiority over the Coffee Arabica and are now planting it pretty extensively on their estates. There can be no question that in a climate like that of Barliyar heavier and more regular crops may be calculated upon from this species of coffee. Nearly half of last year's crop was stripped from the branches before ripening by the high winds in November. However, sufficient was saved to raise nurseries and meet the demand for seeds."

Ipecacuanha has made fair progress, but has not increased in size and vigour, or made root growth sufficient to encourage a hope that it can ever be grown at Barliyar as an article of commerce. At his Excellency the Governor's request some plants are being tried in Ooty. Ceara Rubber trees have done very well, and there is a considerable demand for plants. The cultivation of Jalap has passed beyond the experimental stage, and it is now an established fact that Jalap can be grown successfully in Ootacamund, and will pay a fair return on the outlay, even at the price allowed by the Medical Stores. On the whole, the gardens have been useful to the presidency, but there seems to be something wanting; Rs. 13,000 per annum should produce better results. The experiments are generally on such a small scale that a slight accident may at any time destroy all the Superintendent has got of any new plant, and thus delay the publication of information which may be of vast importance to the agriculturists of the country. Professor Lawson's advent will probably give a stimulus to effort in this department, and we understand he will spend several weeks at the Peradeniya Gardens, Ceylon, before arriving here. There a much larger sum is expended on experiments, and the receipts for plant and seed sold are much higher.—*Madras Mail.*

CULTIVATION OF DIVI-DIVI.

MR. W. R. ROBERTSON, Superintendent, Government Farms, reported to the Board of Revenue in October last that "Divi-Divi bush grows freely at Saidapet and its neighbourhood. We have in the Botanical grounds 17 bushes about four years old, raised from seed obtained from Bangalore which, last year, yielded 18lb. of pods, and they are now bearing again. The seed will be collected and sown in view to the establishment of a small plantation." On the 20th October the Board of Revenue requested Mr. Robertson "to make inquiries as to the demand for the seeds in the market for tanning purposes, and to report whether he thinks an extension of the cultivation would prove financially successful."

Surgeon-Major G. Bidie, M.B., Superintendent, Government Central Museum, reported to the Secretary to Government, Revenue Department, on the 10th November, as follows:—"With reference to G. O., No. 908 of 29th August 1882, I have the honor to state that it appears to me that the Forest Department might institute small experimental plantings of the Divi-Divi where this could be done without incurring much extra expense. So far as my own observation goes, the tree does not grow very freely on the plains, and it is desirable to find out where it will thrive without much trouble, and where the attention necessary to get it to grow would render its cultivation too expensive. If its culture is likely to prove remunerative, the experiments of the Forest Department will be the best means of showing this to the people and inducing them to plant the trees. The Divi-Divi according to my observation thrives best at an elevation of from 2,000 to 3,000 feet above the sea level and likes a fair amount of moisture. The trees at Hoonsoor are the largest and most luxuriant which have come under my notice, and those at Guntoor indifferent." Major J. Campbell Walker, Conservator of Forests, reported on the 16th December as follows:—"I have the honor to submit the following information regarding the Divi-Divi (*Cæsalpinia coriaria*) called for in G. O., No. 908, dated 29th August last. On receipt of the order in question a circular memorandum was issued to Divisional Officers requesting them to report on the cultivation of the tree and the prospects of successfully extending it. Replies have reached me from all districts except Nilgiri and Godavari. The tree is not cultivated in the Kurnool, Trichinopoly, Coimbatore, North Arcot, Palghat, Nilambur, Bellary, Tinnevelly, Cuddapah, and Madura Divisions. The Assistant Collector, in temporary charge of South Canara Forests, reports that he knows of no cultivation in the district, but the Collector adds a note to the effect that he has seen some plants of merely two years' growth which look as if both soil and climate suited them, and that he has three promising young trees of his own. The Head Assistant Collector in charge of Palghat thinks that the tree might thrive in the Walayar Reserve, but fears the moisture would be too much for it elsewhere in his division. The Deputy Conservator of Wynaad Forests refers to a few trees grown in a coffee plantation of Colonel Woolridge, a resident of many years' standing; but gives no information as to their condition or the soil, aspect, and elevation where they are growing. He is anxious, however, to receive seed for experiment. The Deputy Conservator, South Arcot Forests, reports that experiments are being tried by Mr. Weld, Sub-Collector, near Tindivanam, and states his opinion from observation of those and other plants growing a mile from the sea that the tree is likely to succeed in sandy soil at Cuddalore. He has failed in his own efforts to introduce the Divi-Divi into topes and reserves, and the yield from trees he has known elsewhere in the district is not satisfactory. He refers to some trees he recently saw in Wynaad, probably the same as those mentioned in paragraph 5, and describes the wood as white, hard, and useful, and the growth of the tree slow. The Deputy Conservator of Salem Forests states that the Divi-Divi is cultivated to a small extent in his district by private individuals, and, referring to a communication from the proprietor of the plantation near Madras, he advocated the opening of an experimental plantation by the Forest Department in the Salem District. He says a stiff clayey soil is generally well adapted to the tree, but wherever the *Acacia leucophlæ* flourishes, it is safe to plant the Divi-Divi, and this is one of the best guides in selecting a site. The Sub-Assistant in charge of Goomsur and Surada Forests reports that he has now six trees in the experimental teak plantation at Moyagudda, which were procured from Chicacola in 1870, and are now thriving, averaging in height 13 feet with a girth of 2 feet at 1½ feet from the ground. He considers an experiment is likely to succeed. This information is too meagre to justify definite conclusions for or against extensive cultivation, but I agree with Dr. Bidie's suggestions, recorded with G. O. No. 3883, of 20th November last, and think we cannot do better than institute a number of experiments in different localities. I would suggest Mangalore, Nilambur, Walayar, Manantoddy, the Anaimalais, parts of Salem, Tinnevelly, Madura, South Arcot and Ganjam as localities where suitable arrangements could be made for experiments, and if Government approve and obtain seed for the purpose, I will issue the necessary orders. The tree grows fairly well in Madras, and, I believe, in Bangalore, and useful information regarding it could probably be given by the Honorary Secretary to the Agri-Horticultural Society and Superintendent of the Lal Bagh Gardens."

Order of Government, dated 17th January 1883—"The Divi-Divi tree (*Cæsalpinia coriaria*) has long been cultivated to a small extent in this Presidency. It grows and bears abundant seed on the worst soils in Madras. It will probably succeed better at a higher elevation, and in view of the commercial value of its pods and the increase in their export in late years, the Government resolve to sanction the proposal of the Conservator of Forests to cultivate the tree on a large scale in the places named. The Board will call upon Mr. Robertson to expedite the submission of the report asked for in paragraph 2 of their Proceedings, dated 20th October last."

EKMAN'S PATENT PROCESS FOR TREATING WOOD AND FIBROUS PLANTS.

MESSRS. HINDE & CO., of Calicut, who are agents for Mr. Ekman, have now been good enough to fulfil their promise of sending us specifications of patents and also estimates. It appears that the chemical agents used in the process of maceration are sulphuric acid and carbonate of magnesia in the proportion of two of the former to one of the latter, the solution giving approximately 1·4/10ths per cent of magnesia and 44-10ths of sulphurous acid. Magnesia is preferred to either potash or soda as being less injurious to the texture of the wood or fibres treated. The substance to be prepared is boiled in the solution under pressure; gas and steam being also blown off, mainly, it would seem, to prevent burning. Modifications of the appliances employed would

have to be made with reference to materials treated, such as bamboo, rhea, &c., full information being afforded by the agents on reference to them. The royalty on the preparation of paper pulp is £1 per ton of dry pulp produced; the charge for "filaments" and "ultimate fibre" (fitted for textile purposes), we suppose, being somewhat higher, and to be arranged through the agents. Paper works, such as Mr. Ekman's in London, cost £10,000, the machinery alone coming to £7,100, thus :—

Four jacketted boilers 12 feet long inside by four feet diameter, with lead lining, supports and fitting, cost, erected, say £2,500

Two small generating boilers, capable of supplying steam to the other boilers, up to 90lb pressure per square inch, say £350

Kiln, to burn 500 tons of carbonate of magnesia per annum, will cost about £150

Apparatus in laboratory (exclusive of building) to make chemicals for 1,000 tons of dry fibre or paper pulp per annum £600

Eighty-inch paper machine, speeded from 20 to 150 feet per minute, with stuff chests, knotters, back water pumps, intermediate rolls, cooling cylinder, two sets ordinary calenders, damping apparatus, steam engine and gear, would cost, erected £4,000

We are told that working day and night such a machine would produce from 20 to 30 tons of paper per week, say 1,000 to 1,500 tons a year according to the sorts made. Working only by day, which would probably be best to begin with, it would easily make 600 tons a year. It is added that—

The other arrangements of the Mill should be made with a view to working eventually up to the full power of the paper machine.

Then follow long details of breakers, washers, potchers, beating engines, farina and clay-mixing tanks, alum and size, and two colour coppers, bleach-mixing tanks, &c., including a 200-horse power engine and corresponding boilers, bringing the total cost up to £19,795, still apart from buildings; and we are told that such a mill could be increased to turn out 50 tons of paper per week for an expenditure not exceeding £10,000 for machinery, &c.

Such a mill, if built at Calcutta, for the working up of jute with others at Bombay and the various capitals or centres of cotton districts for the preparation of waste cotton, would go a good way to supply the total present demands of India for paper. A turn-out of 50 tons per week would amount in a year to 2,600 tons, or 52,000 cwt., equivalent to 67,600,000lb. But we, in Ceylon, have only a general interest in such huge paper factories. What we want to know is how best to prepare out bamboos, aloes, pineapples, plantains, and other cultivated and wild fibre plants, into "half-stuff" for paper, or clean fibre or textile purposes, with a view to their sale in the London or other markets at profitable prices. Unless the boilers could be easily carried to and erected in the neighbourhood of abundant material, the carriage of such material to the manufactory would be costly, even if small crushing rollers were used to squeeze out the large proportion of water contained in plantain stems, aloe, and pineapple leaves, &c.

The process for the manufacture of paper-pulp from wood, bamboos, or any fibrous plants and for separating valuable fibres such as rhea, jute, hemp, Manilla hemp, flax, &c., &c., from the green ripe stems, is said to be "simple and inexpensive." Let our readers judge from the details given :—

The process is simple and inexpensive, and consists of placing the substances to be treated in a cylinder and subjecting them to boiling under a pressure of 90lb. of steam, in water containing so much surphurous acid, more or less in combination with an alkali or base, as shall be necessary to prevent the oxidation of the organic matter.

To insure perfect success the base must be such as forms tolerably soluble compounds with sulphurous acid. Potash, soda, and magnesia are available for this purpose ; the latter is the best and cheapest, and is principally chosen by Mr. Ekman for his process.

Sulphur and magnesia are therefore the only chemicals required. Necessary buildings and apparatus for the manufacture and manipulation of chemicals cost about £1,000.

To make stuff for 800 tons of paper per annum would require 4 boilers, each 12 feet long by four feet in diameter. One such boiler costs, with lead lining supports and fittings complete, about £500 or £600 erected, and would boil at one operation sufficient wood, &c., to produce 5-12ths of a ton of dry paper-pulp or cellulose, and a boiler can make two boilings a day.

A cylinder, 16 feet in length by 6 feet in diameter, lined with lead, would be sufficient to turn out two tons of dry cellulose every 24 hours ; and this would be sufficient to keep running large paper works such as Mr. Ekman's at Ilford. This cylinder would cost £1,000. The smaller cylinders are probably more suitable for India.

Paper works such as Mr. Ekman's cost about about £10,000.

The space required for joint factories, *i e*, paper and cellulose or fibre-cleaning, would be about 2 acres. An ample supply of pure water free from iron is required for washing purposes ; should iron exist in water at a suitable site for manufactory, it can be precipitated by the use of caustic lime.

Pure cellulose or "wood pulp," and "ultimate fibre" are all produced by the same apparatus, and Mr. Ekman's is the only process by which the most or "ultimate fibre" is produced. The great advantages of the process consist in its simplicity, cheapness, and the non-injury and non-discoloration of either pulp or filaments. To paper filaments and ultimate fibre, prolonged boiling and washing alone is required. But the preliminary arrangements for the preparation of wood and fibrous plants differ considerably, and depends on whether paper-pulp, ultimate fibre filaments, or fibre such as aloe or coir is to be made. Wood will require different preliminary treatment from hemp, and bamboo from rhea. After the raw materials have undergone the patent process, the treatment must be entirely different for paper-pulp for filament and for ultimate fibre ! If therefore a manufactory is to be economically erected and worked, it is necessary to determine beforehand the class of raw material which is to be treated, and the class of fibre to be produced.

Paper-pulp requires beating and washing ; ultimate fibre requires thorough washing; filaments require washing drying, scutching, and heckling. Again, to sub-divide paper-pulp making ; if it is intended to make only ordinary printing papers, small bands, and wrappers, no arrangements for chlorine bleaching will require to be made in the paper-mill ; but to make superior sorts of paper as well as inferior, then arrangements must be made for bleaching by hypochlorite o flime. It is not possible to give any idea of the cost of gear and amount of room necessary to prepare a certain quantity of raw material for the patent process until the *kind* of raw material is defined.

Plans and specifications for the erection of paper mills, or for an apparatus for the preparation of wood or fibrous plants only, can be obtained by sending to the agents at any of the principal towns in India the following information with reference to paper-manufacture :—

1.—The kind of raw material it is intended to use.

2.—The quantity of paper intended to be manufactured per week or month, and the sort of paper required.

3.—An exact plan of the locality where it is proposed to erect the mill, with sections.

As regards fibres for textile purpose—such as the fibre got from hemp, rhea, Neilgherry nettle, Manilla hemp and other numerous fibre plants which abound in India—if a good fibre can be produced from any of this by any process, better can be produced by Ekman's process, and at less cost. If fair sized samples of raw material are sent to Mr. Ekman in London, an opinion will be given—

1.—As to whether they will prove useful at all.

2.—As to whether they are best suited for paper or textiles.

The right to manufacture paper-pulp by Ekman's Patent Process can be arranged for, subject to the payment of a royalty of £1 per ton of dry pulp produced.

The royalty on the manufacture of filaments and ultimate fibre will be somewhat higher and will be especially arranged through the agents—Hinde and Co., Agents, Calicut, Malabar.

Looking at the abundance and the cheapness of white fir in Europe and the low rate at which it can be converted to paper, we do not suppose any one in India or Ceylon will think of meddling with timber woods. Bamboo is in a different category, and if the matured stems, instead of the young shoots as desiderated by Mr. Routledge could, by Ekman's process, be converted into half-stuff, we should think the manufacture might in many localities, especially on the banks of rivers, be profitably undertaken. It is probable, however, that Government authorities would insist on sowing or planting operations sufficient to prevent the extirpation of bamboo forests. In the case of aloes, pine-apples, plantains, &c., the longer and finer fibres would probably be prepared for textile purposes, and the shorter fibres and waste would answer for paper. "Simple and inexpensive" as Ekman's process is said to be as well as effectual, we suppose it is neither simple nor inexpensive enough to meet the conditions laid down by the Government of India, or the Rs. 50,000 prize offered for the best machine for cleaning rhea fibre would be claimed. If we recollect aright, perfect portability was insisted on. Mr. A. Dixon will be able to say if carbonate of magnesia could be easily and cheaply separated from the dolomite limestone which occurs in our mountain regions, and the value of which for agricultural purposes is, we believe, deteriorated by the proportion of magnesia present in its composition. Had sulphate been the form of magnesia required, there would have been no difficulty. The salt manufacturers of India and Ceylon would gladly see utilized a product which, from its bitter taste, purgative properties, and extreme tendency to deliquescence, is, to them, one of the greatest possible nuisances. Deposits of salts in ancient lakes, &c., have frequently been objected to, owing to the mistake of first using the layer of magnesia sulphate which covered the pure sodium chloride ; while in the Mayo salt mines in India, the grey mineral is composed of magnesium sulphate to no less a proportion than 58 per cent. If chemical science includes a cheap method of converting sulphate of magnesia into carbonate (as we believe is the case), abundance of the latter would be available here and in India. But there appears to be an extensive formation (over 8 or 10 square miles) of native carbonate of magnesia (magnesite) in the Salem district of the Madras Presidency ; and it is said also to occur in the district of Trichinopoly, Coimbatore, and Mysore. Apart, therefore, from the cheapness of this agent in Europe, no doubt stores can be gathered or prepared in India, while some of the Indian and Ceylon pyrites might yield the necessary sulphur. We cannot afford space for Mr. Ekman's detailed specification in full, but we quote the paragraphs in which the special merits of the process are described :—

The peculiar character of the invention will be better understood by considering the advantages possessed by it over the usual method in which caustic soda is employed. Instead of using caustic soda, chemicals are employed which have a far less damaging effect on the fibres, and which, especially when magnesia is used, are much cheaper. In boiling with caustic soda, the separation of the fibre from the incrusting matter depends, as is well known, on such matter being rendered soluble by oxidation, but it is impossible to prevent the fibres themselves from being also oxidized

to some extent, thereby weakening and partially destroying them, and diminishing the quantity of pulp yielded by the wood. On the other hand, in the preparation of pulp according to my invention, no oxidation of the fibre can occur when the operation is properly conducted, and the incrusting matter obtained is in the form of gummy matter of commercial value, instead of being converted, as by the old method, into worthless products of the humus type.

Another advantage is that the boiling can be done at about half the pressure required by the usual method, which is of great importance in practice; besides that, the fibre is less liable to be weakened in the process. A third advantage is, that by this method fibre can be prepared which, without any further chemical treatment, is sufficiently white to be used for ordinary kinds of paper, and is capable of supplying a strong good paper without admixture of other fibre. After a subsequent treatment with bleaching powder, it is made suitable for the manufacture of all the finer kinds of paper. This fibre much resembles linen in its physical and chemical properties for paper-making, and is therefore a very valuable material for this purpose.

A fourth advantage is that the solution which remains after boiling contains a gum-like substance which at a small cost can be made to serve as a substitute for dextrine for many purposes, and thereby produce economy in the manufacture. Some portion also of the chemicals used in the solution may be recovered. A further advantage consists in avoiding the injurious effect on vegetation and on animal life produced, as is well known, by spent soda lye resulting from the ordinary method or process.

And, lastly, cellulose of good quality can be prepared at a comparatively low cost by the process hereinbefore described.

Readers interested in the matter can now see whether Ekman's process is simple enough, and also cheap enough, machinery, chemicals and royalty included, to justify them in trying its effects. If not by individuals yet by a Joint-stock Company, we should be glad to see experiments tried. Of fibrous plants a vast abundance is scattered over Ceylon, and a simple and inexpensive, or, if profitable in the end, a costly method of utilizing such plants, would be an immense boon to the colony.—*Ceylon Observer.*

THE WASTE SUBSTANCES USED IN PAPER-MAKING.

AMONG the most interesting of the scientific and technical lectures delivered during the past month was that by Mr. P. L. Simmonds, who discoursed at the meeting of the Society of the Arts on the subject of "The Utilisation of Waste: A quarter of a century's progress." Mr. Simmonds began by saying that though he had often discussed the same subject before the Society, he could not but think that as stock-taking was an important feature, it would be curious and useful to ascertain the progress that had been made in many of the important branches to which he had directed attention since he first introduced the subject to the Society twenty-eight years ago. In the last quarter of a century, very important progress had been made in our home industries and foreign commerce; but certainly the success that had been effected in the utilising of waste products and developing neglected ones was not the least remarkable of recent scientific advances.

Mr. Simmonds then proceeded to deal with animal waste; the former waste of meat in New South Wales and Victoria, when sheep were boiled down simply for their tallow, and the recent development of the preserved meat trade and the transport of foreign meat to Europe. The use of horse-flesh as food was not left unnoticed, and much stress was laid on the enormous waste of portions of animal food that still goes on in the United States.

Of course the manufacture of "shoddy" and "mungo" from a mixture of woollen rags with wool or cotton received attention, as well as the manufacture of waste silk. The adaptation of skins of fishes as well as of animals for various articles, and the adoption of other waste animal substances as manures was touched upon, and then Mr. Simmonds came to consider the subject of

Vegetable Waste,

in respect to which he stated, referring to paper manufacture, that:—Let us pass now to vegetable substances, and I will first consider the paper manufacture. A recent estimate was published, which set down the paper mills of the world at 4,000, producing 1,000,000 tons of paper, of which the half was used for printing.

The quantity of paper of different kinds now made in the United Kingdom probably exceeds 350 million pounds annually. The newspaper press alone has made enormous strides, to say nothing of books, periodicals, and other printing demands. A quarter of a century ago there were scarcely twenty or thirty daily issues of newspapers in the Kingdom; now there are at least 140, many of them papers with very large circulations.

In 1856 we received but 10,284 tons of rags for paper-making from abroad; in 1881 we imported 26,772 tons. Esparto grass was only introduced to any extent in 1861, when 801 tons were received. In 1881 the imports had risen to 192,493 tons, valued at £1,280,211. Besides this we also imported 45,550 tons of wood pulp and other paper-making substances.

It is now evident that the future of the paper industry will in a large degree depend upon the use of wood which is already so extensively employed. For the ordinary varieties of paper ground wood is used, but for the finer sorts chemically prepared wood fibre or cellulose is employed. The practical process for the preparation of cellulose was discovered in 1852, and numerous other processes or improvements have since been invented. It comes into commerce in two forms—wood pulp in sheets or blocks, and ligneous meal or wood flour.

In Central Russia aspen wood is most extensively employed; in Sweden and Finland spruce and fir, which afford the longest fibres; in Germany, France, and Belgium mixed woods. The pulp from beech and birch woods has too short a fibre.

About twenty years ago some of the American papers used the bamboo largely for making paper. This is no new application, for the Chinese have long employed it for a common description of paper. Of late years, however, Mr. Thomas Routledge, of the Ford paper mills, Newcastle, who was the first to utilise extensively esparto grass, has prosecuted extensive researches and enquiries, so as to extend the supply of this excellent paper material. It may be mentioned here, that the number of the Society's *Journal* (November 28, 1850) containing Dr. Royle's paper on Indian fibres, was printed on paper made by Mr. Routledge, entirely of esparto.

The fibrous stem and leaves of the plantain, which is so plentiful in most tropical regions, have not yet been practically utilised, although efforts were made some years ago in British Guiana by a Company. Dr. King, the Colonial Botanist at Calcutta, recently reported:—"It has been found that during the dry months, simple exposure of the sliced stems to the sun is sufficient to prepare the fibre for paper-making, provided the paper mill be on the spot. What is still wanted is some cheap mode of removing the cellular tissue, so that the fibre may be shipped to England without the risk of fermentation on the voyage."

A good deal of the jute sent from India to the United States consists of the dark root, or but-ends of the fibre, which are cut off when the jute is pressed into bales. These are called "cuttings" in Calcutta, and with us, "rejections"; they now form a regularly quoted article of export to America, where they are employed in the fabrication of various shoddy stuffs. In former years these cuttings were thrown away.

The *Dundee Advertiser* of the 14th May 1873 was printed on paper made from jute, and in the issue it was stated:—"This is the first paper, as far as we are aware, ever printed on jute. Being in the centre of the jute manufacturing district, we have been anxious, for some time, to print on the material which has now become the staple of our local manufactures, and we are indebted to our principal paper-maker, Mr. D. M. Watson, of Bullionfield, for carrying out our wishes. It may be explained that this sample is made almost entirely from old jute bagging." To some extent, jute bagging and waste have now been used by paper-makers for several years.

Other waste substances are coming into use with the paper trade, where obtainable in quantity and cheap. Megass, the refuse stalk of the sugar-cane, makes excellent paper. The husks of oats, barley, rye, and rice are also used alone, or combined with other materials.

Straw-board, of late years, has been found to be a cheaper material than the old fashioned "paste-board," and it has come extensively into use in America for paper boxes. The annual product of straw-board in the State is from 35,000 to 40,000 tons.

Straw has long been employed as a paper material, but it is often scarce and dear. It is even found profitable to buy up the bedding litter from the metropolitan stables, and, after washing and disinfecting it, to sell it to the paper mills. The last United States census (1880) showed that more than 270,000 tons of straw were used for paper.*

By the patent process of Chadwick and Clench, the carbonate of soda is recovered from the waste liquors, resulting in the reduction of fibrous materials when manufacturing paper pulp from straw, esparto grass, hemp, jute, and other fibrous materials.

In a paper read last year before the Scottish Society of Arts, by Mr. G. J. Wishart, on the recovery of soda from the spent lye of the paper-maker, he observed:—

"The industrial progress of recent years has in no direction been more marked than in the utilisation of waste materials. New industries have thus been created, and old ones rendered more profitable,

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* The whole materials used were:—

	lbs.
Straw	540,848,600
Rags	418,417,400
Old paper	198,248,0 0
Manilla stock	186,529,200
Cotton-waste	28,598,600
Corn (maize) stock	2,998,100
Esparto grass	587,800
	1,363,811,400

This is inclusive of the wood-pulp consumed.

while grave public nuisances have, in many cases, been removed or abated.

"Were it not for the bye-products obtained from what was once considered waste in the manufacture of paraffin oil, it would be impossible for the manufactured oil of this country to compete with the ready-made article of the American wells. By a similar utilisation, gas—the product primarily sought for in the distillation of cannel coal—can, it is said, be manufactured free of cost; while, in the paper industry, the chemicals employed in the process of converting esparto and other raw fibrous substances into paper pulp are now, to a large extent, recovered, and are thus kept out of the streams they formerly polluted, to the manifest profit of the manufacturer, and the satisfaction—so far—of riparian proprietors."

Until a very recent period, the waste paper of the Government offices of London was the perquisite of the messengers. But when it was found that the aggregate sale of this waste paper reached the sum of £10,000 to £15,000 a year, it was thought time to look into this, and it was then handed over to the Stationery office, and, in the last financial year, the sale of waste paper reached £11,771. Unfortunately, the Government printing is very lavish, every member receiving about a ton weight of Parliamentary documents yearly. The United States Treasurer sells yearly more than 600 tons of paper pulp resulting from the destruction by maceration of Government securities, bank-notes, &c.

In one large printing and publishing establishment in the metropolis, the waste paper in shavings and imperfect impressions exceeds 75 tons a year. Even the newspaper offices now economise and use up their spoiled impressions or overplus papers for printing their posters on.

Mr. Simmonds then went on to consider the utilisation of fibres for brush-making of seeds for producing oil, beet-root pulp for feeding cattle, the molasses of beet sugar for alcohol, and the residue liquor, or "vinasse," for making potash. He then went on to speak of waste substances of the brewery, and numerous other vegetable substances, and concluded with an interesting reference to mineral waste, including broken glass.

In the ensuing discussion Mr. Routledge said the paper trade was probably the one which, of all others, utilised waste products more than any other. They utilised cotton waste, flax waste, hemp waste, jute waste, old ropes, canvas rags, and even, as had been said, stable manure—and he had seen very respectable paper made from that material; they also used spent tan. In fact, the paper manufacturer could use any vegetable fibre whatever, sometimes adding a little animal fibre to give greater strength. Amongst other materials in connection with the silk industry was mulberry bark; it was customary in all silk-producing countries to grow the mulberry leaves on the young branches of the trees, and when these were stripped they were cut down, and had hitherto been burned. Some time ago he tried to collect them in Italy, but found it cost too much; there was, however, an immense quantity to be obtained in India, and it would, he believed, produce paper equal to what Japanese made from the paper mulberry. He had been astounded at the statement in the paper of the enormous quantity of maize wasted in the United States, but could readily believe it, for some years ago, having made an excellent quality of printing paper from maize leaves, he took out a patent for it in the States. When he got there, however, he found the cost of collecting the leaves was so great as to render the process practically unworkable. In some places they actually burned the corn to get rid of it. Allusion had been made to the fact that, in 1856, when he introduced esparto, the Society's *Journal* was printed on paper made from it; and he might add that the year before last a portion of one issue was printed on paper made from bamboo. Asbestos had also been used in paper making, and would be very valuable in some cases, because an uninflammable paper could be made with it. He had some very fibrous asbestos which could be used admirably for what they called a "filler-up." A considerable deal of attention had been given to the utilisation of the plantain tree and banana for paper-making, but his experiments had shown that it contained so small an amount of fibre that he did not see how it could pay. The stems of these herbaceous plants contained 80 to 83 per cent. of water, besides a large quatity of mucilaginous and gelatinous matter which must be eliminated, or else fermentation would set up; so that, practically, he did not get much more than three to five per cent of fibre. He had made excellent paper from Manilla hemp in the shape of old rope, and, in fact, the whole of the greenbacks introduced by the Americans after the civil war were made from this substance. He had bought hundreds of tons at £2 to £3 a ton, but the present price was £12 to £13. It was collected by the Americans and exported, because they found that by chemical means they could bleach it and make magnificent paper material. This hemp was produced by slave labour in the Philippine Islands at a very low cost, and sold here as a semi-manufactured fibre at £25 to £30 a ton for rope-making, and also for making hangings, because it took bright coloured dyes. After being thus used, it came as a waste product to the paper-maker. Jute waste was also used to a large extent; and to-day, although the importation of esparto grass was very large, probably reaching 200,000 tons, without these waste products consumers would not obtain the cheap paper they did, or the cheap periodical which were the result of cheap paper. Wood pulp was likely to assume very considerable importance in the paper trade, two or three new processes having recently been introduced, by which pine wood could be converted into cellulose. He had samples of paper made from it, of wonderful strength and tenacity, very much like parchment. This cellulose could be made in two ways, either by boiling the wood with caustic alkali, or by treating it with sulphurous acid; and when the pulp was manufactured you could hardly tell one from the other. He had recently inspected the process in Sweden, and found the results very extraordinary; but it could hardly be called utilising a waste product, though a large quantity of material was made use of which otherwise would not be of much value.

THE MANUFACTURE OF PAPER PULP BY MEANS OF SULPHUROUS ACID COMBINED WITH A BASE OR OTHERWISE.

(Translated from the *Journal des Fabricants de Papier.*)

SEVERAL patents have lately been taken out in France by foreigners for the treatment of ligneous and textile materials by sulphites of lime, soda, potash, and magnesia, with the object of converting these materials into paper pulp.

In the interest of French industry, and likewise in some degree for its reputation, we consider it a duty to publish *in extenso* the description of a patent No. 116,996, taken out the 12th February, 1877, by M. Lioud, a paper manufacturer at Bourg Argental (Loire).

We shall describe this by extracts, in order of their dates, from the patents taken out in France by M. D. V. Francké, the 13th October 188; by M. M. D. Eckmann, the 10th November, 1881; and from that obtained in Germany, and not in France, by M. Mitscherlich, the 23rd January, 1878—patents all having the same object, claiming directly or indirectly the treatment of vegetable materials, principally wood, by sulphurous acid combined with a base, for the production of paper pulp.

If these several inventors, of whom we neither suspect the good faith nor merit, have already been able to profit by their discoveries in their own countries, and can also profit like other inventors in ours, by coming here to manufacture their paper pulp according to this process, they cannot pretend to demand any remuneration for the invention itself from those who are equally entitled to make use of it, because a remuneration of this kind can only be due in equity and justice to the real inventor as a legitimate reward for his labour and sacrifices.

The patent of M. Lioud is lost, failing the regular payment of the annual tax legally required. If its author has no longer the exclusive right to work in France for his sole profit, this patent for the treatment of wood and textiles by sulphurous acid alone, or combined with different bases to produce paper pulp, and this because he has abandoned it voluntarily, for reasons which we need not enquire into, it is only right that we should give him the credit due to his invention, and that France as well as foreign industry should profit to the utmost extent by the fruits of the invention of one of its countrymen, and this without paying tribute to foreigners who may lay claim to the merit of the same inspirations as the original inventor, *only somewhat later on.*

Patent No. 116,996, 12th February, 1877, by M. Lioud. Title: *The separation of woody and textile materials generally, and their conversion into paper pulp.*

In order to render both woody and textile fibrous materials suitable for the production of paper, it is necessary to break up and destroy the combination which unites their fibres together. In effecting this, however, it is essential to preserve a certain length to the ultimate fibres, while at the same time rendering them fine and supple, failing which the proper degree of felting together cannot be maintained, this being essential in order to produce a good sheet of paper.

By certain mechanical means at present employed, the fibres can be reduced in length, but they still remain coarse and thick; chemical processes, which are daily extending, have the merit of removing from the true cellulose all, or a considerable portion of its incrusting compounds, of separating it, and rendering it supple and fine, while at the same time preserving its length.

The treatment which is the object of this patent consists in the disintegrating chemical action of solutions of sulphurous acid, either alone or more or less combined with different bases. The operation consists in digesting woody or textile materials in these solutions at a temperature more or less elevated and prolonged, according to their respective character, and thus is obtained a product sufficiently disintegrated to felt in a suitable manner, after mechanical treatment, for the manufacture of card-boards or paper. The pulp thus prepared may be employed either for carton or paper.

I claim the treatment of fibrous substances by submitting them, according to their character, to the disintegrating action of solutions of sulphurous acid, more or less concentrated, either alone or combined with bases, and at a temperature more or less prolonged and elevated, a process which renders them fit to be converted into paper pulp by a subsequent mechanical trituration.

Patent, D. V. Francké, No. 145,317, 13th October, 1881: *For an improved process of manufacturing paper pulp.*

According to this specification, a solution of sulphite of lime with sulphurous acid is prepared by causing the vapours of sulphurous acid, produced by burning sulphur or roasting or calcining sulphides such as iron pyrites, to pass up a tower packed with limestone kept moist by a flow of water.

It is in this solution at 4 or 5 degrees Beaumé, that the materials to be treated are boiled under a pressure of from 4 to 5 atmospheres during 12 to 15 hours.

M. D. V. Francké claims as his invention the production of paper pulp from wood, esparto, from corn, maize or other straws, or from any other suitable fibrous materials, by treating them with an acid sulphite of lime prepared and applied as he describes.

An additional certificate, dated 21st December, 1881, follows:

This patent commences by declaring, having now found that the acid sulphites with other alkaline earths, such as magnesia or the soluble alkalies of soda and potash, are also applicable to his process, and he describes the method of preparing such solutions.

For an alkaline earth such as magnesia, or a mixture of magnesia and lime, the process is the same as for lime: to treat a soluble alkali such as soda or potash, he fills the tower with some inert material, porous, however, such as coke, bricks, or porous stone, and while the sulphurous acid vapours traverse the tower from bottom to top, he percolates or pours over the porous material an aqueous solution of the caustic alkali. The liquid collected at the bottom of the tower is the sulphite of the alkali.

In this additional patent, M. D. V. Francké claims as his invention:

The method of extracting from alkaline earths or from an alkali a sulphite applicable as a dissolvent for the production of paper pulp. 2nd: The manufacture of paper pulp by treating wood, straw, or other vegetable fibres by acid sulphites of an alkali, prepared, and applied essentially as described.

Patent, Daniel Eckmann, No. 145,744, 10th November, 1881. Title: *Improved method for the treatment of wood in order to obtain fibres suitable for the manufacture of paper.*

The following is the description of this process, having for its object the production from wood of a fibrous pulp suitable for the manufacture of paper and other purposes. It consists in digesting wood under pressure in a solution of sulphurous acid and magnesia under certain conditions described.

Potash and carbonate of soda may also be employed, but the inventor prefers magnesia, because it is more advantageous, and possesses chemical properties which render it peculiarly suitable for this process.

It is therefore upon the hypothesis of the employment of magnesia and the wood of white pine of good quality and fine grain the following description is based.

The wood, deprived of its bark and its knots removed, is cut into pieces 15 to 20 millimetres in length, and crushed between two rollers so that the solution may readily penetrate it; this preparation, however, may be otherwise effected.

White pine, and the other woods of this species, are particularly suited to be treated by this process; they afford for the manufacture of paper fibres long, strong, and very pure, resembling in character those of hemp. This species of wood is very abundant in all countries, and generally cheap.

The suitability of other woods for this purpose depends chiefly on the length and quality of their fibres, and upon the greater or less facility with which their incrusting compounds are dissolved. The choice of wood, therefore, is determined by the purpose for which the pulp is to be employed.

It is desirable in general to avoid employing very resinous woods, on account of the difficulty of sufficiently dissolving the various incrusting compounds in order to produce good cellulose. The wood is sorted with more or less care, according to the pulp which it is desired to produce: when a superior quality of pulp is desired all resinous pieces, also those which are hard or decayed, are rejected.

The wood thus selected is sorted over as required, and filled into a boiler with a double jacket, lined in its interior with lead, and so arranged as to turn on its trunnions to facilitate charging and discharging.

It may be a vertical cylindrical boiler, 1·200 m. diameter (4 feet) by 3·600 m. (14 feet) high. The boiler is filled with wood to two-thirds its height, and the solution should cover the contents, so that during the whole period of the operation the contents should be always covered, still leaving sufficient space for steam. A plate of lead pierced with holes prevents any rising of the materials. The cover is then secured by a steam-tight joint. The boiler is also furnished with a valve or stopcock to be regulated by the hand.

In the preparation of the ley it is desirable to obtain a solution containing about two equivalents of sulphurous acid for one equivalent of magnesia, or approximatively in the proportions necessary to constitute a double sulphite, or the salt known as bi-sulphite of magnesia. The solution then contains very nearly 1·4 per 100 of magnesia and 4·4 per 100 of sulphurous acid.

The steam is introduced into the jacket, to begin with, at a pressure of 10 to 15 lb. per inch; so soon as the pressure in the interior of the boiler attains 5 lb. per inch, the stopcock is slightly opened to permit of the escape of a small quantity of gas and steam. The pressure in the jacket is increased gradually as the pressure in the interior boiler increases, and it is recommended that the excess pressure in the first shall not exceed that in the second more than 30 lb. per inch (two atmospheres 1-10").

As the pressure in the inner ley boiler increases, the escape of gas and steam should also be increased, to avoid either the burning of the discoloration of the wood.

In a boiler of the dimensions described the operation should be conducted in such a manner that the pressure in the ley vessel reaches 25 lb. in two hours, and that it increases 20 lb. per hour during the two succeeding hours, 15 lb. during the next hour, and 10 lb. per hour during the following two hours. When the pressure reaches 85 to 90 lb., this is kept up a further three hours, when the operation is finished, this being proved by a peculiar smell given off by the gases which are allowed to escape through the blow-off cock.

In the event of the wood becoming charred or discoloured, which is indicated either by the characteristic odour of the gases allowed to escape or by the colour of the ley, the further admission of steam is arrested, the boiler is emptied, and the wood washed.

When no burning of the wood is indicated, it may be allowed to remain some time longer after the admission of steam to the jacket has been stopped, the boiler is then emptied and the wood drained. The resulting pulp is triturated and washed, as usual, and the ley, by suitable treatment, furnishes a gummy substance which in many cases may be used as a substitute for dentrine. It may also be treated to recover the chemical agents that have been employed.

When it is desired to produce a pulp o f lower quality, by abstracting a less quantity of combined compounds, a ley less concentrated is employed at a lower pressure.

The proportions of the elements of the ley may be varied, noting, however, that the solution of the incrusting compounds will be less complete the more basic the ley, and the production of the pulp much more readily attained the more acid the ley.

It has been remarked that the pressure should not exceed 85 to 90 lbs per inch, because within these limits good results are attained, and a higher pressure would not be desirable in an economical point of view; these limits, however, are not absolute, as good pulp has been obtained when the pressure has been carried to 110 lbs or even higher—8 atmospheres or more.

The pulp thus produced is suitable for ordinary printing papers, and when treated by chloride of lime, for papers of finer quality.

The ley, which is of an amber color, contains a large quantity of gums resembling dextrine, and some other soluble substances, susceptible of being more or less utilized.

When the separation of the compounds incrusting the cellulose is less complete, the pulp is suitable for papers of inferior quality, for carton, and for papier maché.

The process is readily employed for other woods besides white pine, with suitable modifications. The quality of the pulp will always depend, within the limits stated, upon the suitability of the wood employed for the manufacture; thus, very resinous wood, although its fibre may be very good, is only suitable for inferior papers, on account of the difficulty of abstracting the incrusting compounds.

The peculiarity of this process for the manufacture of pulp consists in a consideration of the advantages it possesses over the customary process with caustic soda.

Instead of soda, materials are employed which have much less action upon the fibres, besides which they cost much less, especially when magnesia is employed.

By the soda treatment, the separation of the incrusting compounds from the fibres depends upon the former becoming soluble by oxidation; but the cellulose is also at the same time inevitably oxidised, the fibre thus loses its strength, and the yield of pulp is also less.

When the new process is judiciously conducted, no oxidation of the fibres can be produced, and the incrusting compounds are obtained in the condition of gums, which have a commercial value, instead of being of no value like those resulting from the soda process. Another advantage derived is, that the treatment of wood by the bi-sulphite of magnesia only requires half the pressure necessary by the soda process. A third advantage is, that the pulp produced by this system is sufficiently white, and can be employed, without other chemical treatment, for ordinary white papers, and affords, without any addition of other fibres, a good and firm paper. If the pulp is bleached by means of chloride of lime, it may be used for all fine papers.

The pulp evidences in its conversion into paper physical and chemical properties analogous to those of hemp; it is, therefore, suitable for similar purposes. A fourth advantage results from the leys, after the boiling, containing a gummy substance, which at low cost may be converted into a substitute for dextrine; a portion also of the materials employed for the ley may be regenerated.

A still greater advantage is, that the process has no influence either on animal life or vegetation, while such is not the case with the process employing soda.

Finally, the cellulose is of excellent quality, and can be produced at a comparatively low cost.

M. Mitscherlich, of Munden, has taken out in Germany a Patent dated 23rd January, 1878. Title: *Novelties in the processes of extracting tannin, with recovery of the bi-products, cellulose, gum, acetic acid, double sulphite of lime.*

Description: The process consists effectively in the action of double sulphite of lime, or sulphite of lime dissolved in a solution of sulphurous acid, upon vegetable substances previously digested by steam, for example wood, at a temperature above the point of the ebullition of water.

In what follows, wood alone will be referred to, although the process is equally applicable to all other plants.

The solution of double sulphite of lime is obtained by causing to pass simultaneously through carbonate of lime, reduced to pieces of medium size placed in a tower, a current of water flowing, from the top to the bottom of the tower, while a current of sulphurous acid gas is caused to pass in the reverse direction.

The sulphurous acid is produced partly by the burning of sulphur, or other sulphur mineral, and partly by the evaporation of a solution obtained as hereinafter described; in the same manner, other sulphurous salts, such as sulphite of soda, may be obtained at low cost, which can, under certain conditions, be equally employed for this process.

The wood with the bark taken off, cut by a saw into pieces of suitable length, either with or without the knots, is placed in an iron boiler covered with cement and lead, furnished with heating tubes, and the necessary apparatus for the entrance and exit of liquids and vapours. The wood is first submitted to the action of steam, and then boiled in the solution of bisulphite of lime, a shorter or longer time, according to its state of division, but at least during eight hours, at a temperature of 180 deg.

During the process, the compounds which are not cellulose are dissolved in the solution, the latter remaining as a softened mass. The contents of the boiler are then submitted to evaporation so long as the vapours escape, and they are conducted into the tower containing the carbonate of lime previously mentioned, still bearing the smell of sulphurous acid. These vapours may also be conducted into a reservoir containing water and pure slacked lime, and thus may be obtained a concentrated solution of bi-sulphite of lime, the use of which is extending more and more for preventing the fermentation of acetic acid and other non-fermentable compounds.

If the carbonate of lime is replaced by carbonate of soda, soda-salts of different degrees of acidity are readily obtainable. The solution in which the cellulose remains is then drawn off. It contains besides the salts of lime, plaster, &c., tannin, gummy matters, acetic acid, and a little sulphurous acid. Up to the present time it has chiefly been employed as follows:—

(a) As a material for tanning skins.
(b) For the manufacture of gum.
(c) For producing vinegar.

(a). The solution may, without any other preparation but concentration, unless employed where it is produced, be used for tanning, because the bi-products, other than tannin, which it contains, have no damaging effect in tanning.

The tannin may likewise be precipitated by lime, and separated after a given time from the dried precipitate by means of an acid.

The patentee remarks that the small quantity of sulphurous acid contained in the solution expedites the tanning process and increases the solubility of the bi-products in the solution. The tanning matters of the solution, when it is employed as it is produced, retain the properties of the bark of the wood from which they are derived. If, for example, the wood is pine, the natural colour of the skins will be as little changed as if the bark itself were used, but the colouring action is modified in certain cases when the solution has been treated by lime and acid as previously described.

(b) For the manufacture of gummy products, the solution is simply evaporated, the sulphate of lime crystallised, and separated by decantation. The residue of a brown colour, very deliquescent, replaces in many cases gum-arabic.

The residue dried in the same manner as the concentrated solution can be kept indefinitely without any trace of decomposition or mouldiness. For some purposes it is desirable to precipitate the lime by sulphuric acid, and to separate the sulphurous acid disengaged by evaporation, or to convert it into sulphuric acid by the addition of an alkaline chloride. For other purposes, it is necessary before using the gum to eliminate the the tannin.

(c) The acetic acid is obtained by condensing the vapours which are disengaged during concentration. Alcohol may be obtained by the fermentation of a portion of the solution.

The insoluble portion which remains in the boiler is the cellulose, with a part of the knots of the wood, the condition of which is but little altered on account of their density, and which may then be readily separated by mechanical means. The cellulose, nearly white, is obtained by this new process in much larger quantity than hitherto: thus, for example, pine-wood, air-dried, will yield 66 per cent of cellulose. This is fit to be employed direct, or after having been bleached, for the manufacture of paper, and even for the the production of tissues.

The advantages of this new process over those now in use are, that it requires a less minute division of the wood, a temperature and a pressure so low that the boiler is not affected, and that all chance of explosion is avoided. The preliminary digesting in steam materially facilitates the reaction of the bi-sulphite of lime on the wood. The yield of cellulose is greater.

The patent, the description of which we have just read, has evidently for its principal object the manufacture of *paper pulp*. The assertion that the yield of cellulose from air-dried pine should be more than 66 per cent is specially to be noted, as it has been considered till to-day that no wood has given more than 40 per cent yield. If by Mitscherlich's process 66 per cent or more is obtained, it is possible the pulp obtained is not pure cellulose, but contains a large proportion of the incrusting compounds of the wood, transformed and bleached.

It appears from the circular of a manufactory employing this new process that the unbleached pulp may be employed for white paper without any other preparation than an energetic washing by plain water.

To avoid any accident when sizing, it is desirable to add before doing so a small quantity of bi-sulphite of lime. This compound, which constitutes according to the previous description the basis of the manufacture, can be delivered from the manufactory in solution, in carboys, or casks preserved by petroleum.

In the event of a higher white colour of the pulp being desired, this may be obtained by treating with chloride of lime. It is recommended when doing this for economical reasons to add a small quantity of milk of lime. The reason for doing this is not explained.

This process, for which no patent has been taken out in France, has been employed in Germany before either M. Francké or M. Eckmann made application for their patents.

CINCHONA.

THE CINCHONA TRADE.

It is a frequent remark that there must needs be a limit to the demand for, and consumption of quinine; and it is argued that those who are planting cinchona largely, in confident expectation of the maintenance of present market values, are likely to be caused severe disappointment, when they commence to reap their harvest of barks. The Madras, Bengal, and Netherlands India Governments have undertaken the cultivation of cinchona, not in view to making a profit from it, but primarily in order to render cinchona more

abundant, and thereby to bring quinine more readily within reach of the fever-liable multitude. Quinine is not exactly the kind of medicine that one would go out of one's way to indulge in unnecessarily. It is bitter in the mouth; it leaves an acrid taste; and it is apt to make the head swim, and the ears to buzz. But year by year the demand for quinine increases, and this demand has produced a great increase of supply, coupled with the maintenance of a high and profitable range of prices. In 1870 the quantity of cinchona bark imported into the United Kingdom (chiefly into London, which is the chief market for the commodity in the world) was 2,536,568 lbs., valued at £218,565, or at 1s. 8¼d. per lb. Twelve years afterwards, or in 1881, the imports amounted to 14,040,096 lbs., valued at 2s. 5d. per lb., or £1,814,501. Thus the quantity imported increased by over five and-a-half times, yet the average market price rose by a half. The importations from India were so small prior to 1876 that they were not thought worthy of special notice, and were included statistically in the quantities received from America and other countries. In 1876 they stood at the modest total of 158,480 lbs., valued at £22,682 ; in 1877 and 1878 they stood at about half-a-million pound, valued at about £75,000 ; in 1879 they shot up to 1,004,080 lbs., valued at £146,376 ; whence they rose in 1880 to 1,814,786 lbs. valued at £215,068 ; and in 1881 to 1,864,912 lbs., valued at £248,894. So in the six years ending with 1881, the quantity and value of Indian cinchona bark increased by over eleven times. India, however, supplied in 1881 but little more than a sixth of the quantity of bark taken by the United Kingdom. She ranked notwithstanding second on the list, and was followed by Peru—the original home of "Peruvian Bark"—with 1,169,168 lbs., France with 1,067,808 lbs., Ecuador with 1,016,736 lbs., United States with 489,664 lbs., &c. Columbia headed the list with 7,945,728 lbs., valued at above a million sterling, in 1881, as compared with 989,408 lbs., valued at £84,330 in 1870. In 1878, 1879, and 1880, the imports from Columbia amounted to about 2,500,000lbs., and in 1881 they nearly touched 8,000,000 lbs. The increase was chiefly due to the newly discovered Cuprean Bark. The total imports and exports of the United Kingdom were :—

Date.		*Imports.* lbs.	worth £	*Exports.* lbs.	worth £
1870 ...	...	2,535,568	218,565	1,431,920	123,375
1871 ...	...	2,356,816	285,976	2,017,344	154,180
1872 ...	...	3,186,512	285,620	2,132,256	224,043
1873 ...	...	5,121,424	456,066	3,274,320	311,645
1874 ...	...	4,723,264	442,241	3,399,952	390,042
1875 ...	...	4,091,472	374,150	3,536,400	307,137
1876 ...	...	2,914,352	272,154	3,804,080	391,209
1877 ...	...	3,908,800	402,169	2,583,616	415,450
1878 ...	...	6,035,232	867,376	3,791,472	647,777
1879 ...	...	6,796,272	970,333	4,657,296	649,185
1880 ...	...	8,917,776	1,183,361	5,415,312	611,165
1881 ...	...	14,040,096	1,814,501	7,047,600	730,050

The average price per annum was—

1870	... 1s.	8¼d.		1876	... 1s.	10½d.
1871	... 2s.	5d.		1877	... 2s.	0½d.
1872	... 1s.	9½d.		1878	... 2s.	10¾d.
1873	... 1s.	9¾d.		1879	... 2s.	11½d.
1874	... 1s.	10½d.		1880	... 2s.	7¾d.
1875	... 1s.	9¾d.		1881	... 2s.	7 d.

The mean average for the twelve years was 2s. 2¼d. It is a curious circumstance mentioned by Mr. John Hamilton, of Great Tower Street, London, to whom we are indebted* for these figures, that in 1881 England imported 1,067,808 lbs. from, and exported 1,084,272 lbs. to France. The actual consumption of bark in France rose from 1,764,600 lbs. in 1877 to 4,277,145 lbs. in 1881, and the price from 2s. 4½d. in the former to 2s. 10¾d. in the latter year. There are now four quinine manufactories in France, *viz.*, two in Paris, one at Argenteuil, and one at Ivry. Germany imported and used 1,430,000 lbs. in 1877, and 4,769,160 lbs. in 1881 ; paying 2s. per lb. in the former and 3s. 2d. in the latter year. Italy imported 990,080 lbs. in 1877 and 5,546,240 lbs. in 1881. Mr. Hamilton says :—"A good deal of bark is used in its rough state by the inhabitants of marshy and feverish parts of the country, in addition to the ... annually consumed by the important manufactory at ... ing quinine. I am told that in 1881 as much as ... was used for the manufacture of quinine alone." Lastly, Holland received from England 2,910,320 lbs. in 1881, from Government plantations in Java 178,296 lbs., and from private plantations 90,244 lbs. ; and the United States imported 4,201,372 lbs. in 1881.

We gather from the Administration Report of Madras that on the 31st March 1881 there were 847 acres under cinchona cultivation belonging to the Government with 677,350 plants. Between 1874-75 and 1880-81 nearly three million plants were raised, and the produce in bark rose from 57,250 lbs. to 243,245 lbs. In 1875-76 the Government realised Rs. 60,404 from the sale of bark, and in 1879-80 Rs. 4,24,323. The report does not state the area of land under cinchona cultivation by private individuals.—*Madras Mail.*

* Statistics of Cinchona Bark, by J. Hamilton. London : J. W. Collings, 1882.

FORESTRY.

TREE PLANTING IN BENCOOLEN.

BATAVIA.—During the month of November last, the authorities at Bencoolen made praiseworthy exertions in planting useful trees, the success of which will greatly benefit the population of that residency now in such a backward state. It is almost incredible that the *asam* or tamarind, so indispensable in Java cookery, is so scarce in Bencoolen that it has to be imported from abroad for the consumption of the people. In the compound of the Resident's dwelling, three nurseries of tamarind seedlings have been laid out, with the object of planting them on the roadsides where now either worthless trees or none at all grow ; thereby glorious shade and charming lanes will be secured. About 1,000 Banda nutmeg seeds have been sown hitherto with successful results. It is intended to distribute the plants from them among the population to replace the too old and dead trees in the many but sadly neglected nutmeg plantations there, whereby it is hoped to raise from its present declining state the cultivation of that product which formerly was a source of abundant profit to the people. A similar experiment, says the official Java *Courant*, will be made with seeds of the Banda *kanari* trees from whose hard fruit, eaten like hazelnuts, a pleasant oil is extracted.—*Java Bode.*

THE PROTECTION OF FORESTS.

THIS matter forms the subject of an article in the current number of the *North American Review*, written by Professor Sargent. It has reference especially to North American forests. After alluding to the difference in the forests of the Atlantic, Central, and Pacific regions respectively—differences with which our readers are familiar from the writings of A. Gray and Hooker—Professor Sargent goes on to remark that "the distribution of the forests over the continent shows that where the rainfall is heaviest, the forest growth is heaviest ; that where the rainfall is light and unequally distributed, the forest is proportionately light ; and that where the average annual rainfall sinks below a certain amount—about 20 inches—the real forest disappears entirely. Speaking of the maintenance and reproduction of forests, it is truly stated "that a forest in which a regular succession of young trees is not coming on is always in danger of speedy and entire destruction." Fire is the greatest enemy to the American forest ; next to fire, the browsing animal inflicts upon it the greatest damage ; and the American people, in generally using their woodland for pasturage, have adopted the surest method to compass the final destruction of their forests. In spite of this, the unequalled forests of fir of the north-west coast hardly show the marks of thirty years of cutting and annually increasing fires. In this humid climate young trees of the same valuable species spring up so quickly on land stripped of its original forest covering, and these new forests grow with such remarkable rapidity, that there is little danger of their final extinction. Serious and often fatal injury has been inflicted on the Sierra forests, however, by the sheep which every summer are driven up by thousands to pasture in the cool moist subalpine meadows of those high mountains. The sheep, enforced by great bands of horses, cattle, and goats, clean everything before them—nothing but the large trees and the most stubborn and thorny "chapperal" escape their voracity. Every young tree, every bud, and every blade of herbage is devoured, everything green is destroyed, and the sheep tread out from the dry, gravelly hill-sides the roots of all young and delicate plants. The Sierra forest is over most of its extent a forest largely composed of full-grown trees, containing but few young seedlings, and little undergrowth to shelter and protect them. Its condition, then, is critical, and unless measures can be taken for effectually limiting the range of browsing animals, its total extinction must be merely a question of time. A forest crop is slow to mature, its area cannot be extended or reduced in response to large or small demands. A forest fire may destroy in a single day the growth of 500 years, and which another 500 years can hardly replace. Although the forest does not cause the rain to fall, it husbands it after it has fallen. It serves as a mulch on the earth's surface, it prevents the too rapid flow of water from the surface, checks evaporation, breaks the force of destructive winds, and prevents the soil on the mountain-side from being washed away. The great value, then, of the forest lies in its power to protect the surface of the ground from denudation, to regulate the flow of rivers, modify temperature, and preserve the rain.

TEA.

INDIAN TEA IN KASHGARIA.—The *Bombay Gazette* says :—People who are interested in Indian tea will learn some curious facts in Colonel Kuropatkin's "Kashgaria." Before the year 1864, when the Chinese were driven out of Kashgaria, the inhabitants got their tea from China, along the great trade routes. When this source of supply was cut off, and the stores in hand exhausted, the leaves of an indigenous plant called surrogatino were used instead of tea, the infusion being rendered palatable by the help of salt, butter, and milk. Then tea began to be imported from the Russian territory and from India. Chinese tea came in *viâ* India. Kuropatkin mentions that even at Tashkend Chinese tea is sold which has come from Canton to India, and thence by the Suez Canal to Odessa, and so round to Central Asia. Naturally the Indian tea is much cheaper than Chinese tea coming by such a roundabout route, but it is considered inferior in quality. It is smuggled across the Russian frontier, "to the great disturbance of Russian tea traders." According to a moderate computation, it seems that the Kashgarians would consume about £56,000 worth of tea per annum ; the quantity going to them across the Russian frontier amounts to rather less then £4,000. Latterly the Chinese tea is beginning to find its way along the restored trade routes to Kashgaria, and Kuropatkin thinks it will drive out not only the Chinese tea coming round from Canton *viâ* India and Russia, but the Indian tea imported direct. And it will, he expects, find its way into Russian territory also by the restored routes. "Tea of Indian growth," he says, "however cheap it may be, is less advantageous to us than the Chinese article. At present in exchange for tea we dispose of our manufactures, especially cloth, to China, whilst for Indian tea cash exculsively must be paid." It would be denying a pleasure to Indian tea-planters to omit the very next sentence, in which the writer shows that his particular reason for encouraging Chinese as against Indian teas is about to cease and determine. "Unfortunately of late our [Russian] trade relations with China have become so bad that if we do not adopt measures, China will disappear altogether as a market for our wares, and for China tea we shall then have to pay exclusively in hard cash." As it will take less of this somewhat scarce commodity to buy Indian teas, India will then have a very good chance of getting the supply of the Central Asian market into her hands, provided Kuropatkin's advice to impose "a heavy tax on Indian teas," as well as upon English goods, be not acted upon. Even if it be, there will be room for a considerable extension of the smuggling trade to which that gallant officer refers.

COCOA.

SHAND'S PATENT TEA DRYER AND COCOA CURER.

BESIDES a tea dryer, Mr. Shand claims that his invention, as we have before stated, will be equally efficacious with cinchona bark, and particularly with the curing of cocoa. Various experiments have been tried by Mr. Shand, which all go to prove that, beyond doubt, the sun-drying of cocoa after fermentation can be equally well performed by this machine. About 70 lbs. of cocoa nibs were placed at Mr. Shand's disposal, wet from the pods by the Ceylon Company, and laid about 4 inches deep over the galvanised iron plate or boiler, an equal temperature of about 170 deg. es being maintained. We have already described this machine in an issue of a few days ago, so that further details are unnecessary. The object kept in view with regard to this experiment was, whether or not the two processes of fermentation and dryinge ould be amalgamated into one. About three days after the nibs were first placed on the machine they were perfectly dry, and the inside kernel had a very rich, dark, chocolate colour. The system has only one disadvantage, namely, that the outside of the bean was a dark, dirty shade, due to the mucilage having dried on the bean.

Another experiment was tried. On a larger though similar machine a quantity of fresh and wet beans were placed and an equal temperature kept up (*i.e.*,170 degrees), but the layer of beans was of the thinnest and in a few hours the beans were perfectly dry The outer skin had, however, split from exudation and the outside of the beans was again dark. In this case, Mr. Shand made some chocolate, which we had the opportunity of tasting about 24 hours after the wet cocoa beans had been deposited in his machine !

With regard to these experiments, one thing is certain, that, whether the fermenting can be amalgamated with the after drying in one process or not, there is no difficulty whatever in drying cocoa after it has been fermented, so that, if this is established beyond a doubt, the principal difficulty encountered by the cocoa planter will be overcome. Fermentation, which usually takes about eight days, can always be done in the estate store, and is the simplest thing in the world, all that is required being to heap a quantity of the nibs to gather on the floor, or in a bag, or tub, when in about eight days the whole is completely fermented.

The great and almost insuperable difficulty is that immediately after the fermentation is completed, the beans must be placed at once in the hot sun for the space of three days. Should there be no sun the whole of the picking is lost. It will be at once seen how difficult it is to make certain of turning out a good sample, owing to the fickleness of our wet climate and the immense advantage a machine such as Mr. Shand's has over a combination or meteorological conditions. The inventor is, however, of opinion that, with prefectly fresh beans—of course the beans experimented with were some days old—and a lessening of the temperature to about the point where natural fermentation stops, say, 120 degrees, the same effect will be produced; and, as a consequence, no two processes will be required. We recommend cocoa planters to purchase a small model machine from Mr. Shand. It can be obtained with full directions for *Rs.* 10, is quite as good a test as a larger and more expensive machine, and can be heated by a kerosine oil stove placed at one end.

Tea has been successfully fired on this machine, and though large and more extensive experiments are requisite before pronouncing definitely as to its complete success, we have but little doubt it will prove to be as useful and efficient as other machines, while irrespective of the advantage of its cheapness, it has excellencies of its own which, should they be confirmed by similar results on a larger machine and more extended scale, cannot fail to bring the patent into general use.

TOBACCO.

TOBACCO IN BORNEO.

ACCORDING to a Samarang paper, the *Indische Vaderland* of the 20th December, the Netherlander from Deli who has been inquiring into the suitableness of North Borneo for tobacco-growing is Mr. L. F. Saunders, who had been commissioned by the British North Borneo Company to ascertain whether the tobacco grown by the natives there would answer, when planted and prepared for the European market. Mr. Saunders thus sets forth the result of his researches in the coast district :—

"I was rejoiced to find that the genuine tobacco plant, and not the inferior wild variety, grow very luxuriantly in Sabah, and that the product was of such a nature that even under the careless management of the natives the leaves reach each a length of one foot. The seeds and hence also the tobacco are indigenous, and may be considered as belonging to the 'Palembang' variety. The leaf terminates where the midrib commences, the latter being bare with the exception of a few small hairs. In shape the leaf is very broad at the lower end, and is only ovally rounded off at the point, while both leaf and fibres leave nothing to be desired in fineness. The almost total freedom from holes, notwithstanding the notorious indolence of the growers, furnishes proof of the fortunate absence of worms, locusts, and other vermin. During the growth of the tobacco plants, rain showers usually fall at night, whereby spotting and rust are prevented. So far as I can judge from a single season's samples, the ash is pure white, and the smell is not only unobjectionable, which alone would be enough for tobacco intended only for covering, but even pleasant so that the smaller leaves available at each crop and used as filling will be more suitable for that purpose than many Java kinds. The seasons and rainfall are favourable. The rainy season begins in the middle of August, so that the beginning of April is the fittest time for planting. In configuration the country traversed consists of steep hills with small tops, while plains are either altogether absent or almost so, what few there are being only in the valleys between the hills. After clearing the ground the natives plant paddy on the slopes of these hills, and afterwards tobacco in small quantities, but only for their own consumption. I found tobacco growing luxuriantly at the height of 3,000 feet, showing all the good qualities enumerated above. It struck me that the elevation of the land exercises a favourable influence on the fineness of the leaf." Mr. Saunders describes the formation of the soil in Sabah as very suitable for tobacco cultivation, the chief difficulty to be overcome being scarcity of labour, while land transport will be found indispensable, from the currents in the numerous rivers and streams being too strong and dangerous for the conveyance of produce and materials. Towards the conclusion of his trip, he examined in the valley of Rachak the most extensive tobacco plantation he had yet seen, its area being half an acre, and collected there many large green leaves for the purpose of drying them by way of experiment. Mr. Saunders, though admitting that the quality of tobacco can only be ascertained after being thoroughly fermented and cured, comes to the following conclusion :—"Without arousing too great expectations, it may safely be assumed, considering the favourable ascertained characteristics of variety, size, fineness of leaf, smell and ash (unfermented), that at a height of 2,000 feet on land not too hilly, and with a European mode of cultivation, tobacco crops of superior quality may probably be secured."

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NOTICE.

SUBSCRIBERS to the STATESMAN, FRIEND OF INDIA, *and* INDIAN AGRICULTURIST *are informed that arrangements have now been made by which these journals will for the future be published under the general superintendence of the undersigned.*

All communications concerning the general business of the STATESMAN AND FRIEND OF INDIA *Office, Advertisements, and Subscriptions to the* daily STATESMAN AND FRIEND OF INDIA, weekly FRIEND OF INDIA AND STATESMAN, *and* INDIAN AGRICULTURIST, *should be addressed to the MANAGER.*

All communications regarding literary matter should be addressed to the EDITOR *of the paper for which it is intended.*

WILLIAM RIACH.

June 13th, 1881.

CONTENTS:

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

CORRESPONDENCE.

THE SILK INDUSTRY.

TO THE EDITOR.

SIR,—In your esteemed columns long letters have been appearing regarding the Bengal silk. Your correspondents generally bemoan the fate of Bengal silk as an industry that is dying off, abuse the spinner or *katanies*, and try to prove by various and many arguments why the silk in Bengal will never be again what it once was, and what ought to be done to resuscitate it, &c.

I have had a good many years of experience of silk filatures, both on the Rajshaye side of the Ganges, and on the Moorshedabad side too. I have also seen something of it in Beerbhoom and elsewhere, and even now I hear one way and another a good deal about silk filatures.

My experience goes to show me that, so far from the silk industry dying out, it is very flourishing; but of course as the Europeans have done their best, and are doing their utmost, to make dealings with them disagreeable to the dealers in cocoons why, they are losing the business, and as the local consumption of silk has increased a hundred-fold, and cannot be traced by the European producer or the Government, it is lost sight of, and a "hue and cry" is raised as to the falling off of the silk industry.

One of your correspondents writes as if he was training for Holy Orders, and dogmatically lays down the law by stating that a small filature contains fifty men and fifty women, and a large one five times as many of each sex. He does not know that, across the Ganges, on the Rajshaye side, where probably 30,000 to 60,000 hands reel silk every day, during the season, there are not among them 50 women katanies. I knew a charge of 900 basins in which there was not one female katanie, and most of the men were married men with families, and many of them kept their women as *purdanusheens*—*i.e.*, their women were not permitted to be seen out of their homesteads. How is it that the curse complained of on the Moorshedabad side, where single men and women carry on much of the work, falls on the respectable lot too?

Again, one man writes about "rack-renting:" that, too, is absurd. If the mulberry fields were to pay three times the rent they are now charged with, they would still leave a handsome margin to the cultivator.

Lastly, comes a man who wants to run off with the cocoon eggs to the hills, and abuses the Bengali katanie as being incapable and lazy, &c.

To this man I say there is no more patient worker than a Bengali, and value for value, the Bengali workman will beat any workman except the Chinaman.

Then, as to cocoons. If your correspondents can afford to do prodigies, then of course they can call out *nous avons changé tout cela*, but as they cannot, I suppose things must remain as at present.

To any one who has been behind the scenes, and to any one who has studied the subject, the reason for the decline in the quality of Bengal raw silk, as sent to the home markets, is very plain indeed.

The cocoons taken all in all are much as they were formerly. There are good batches and bad batches, and the best of silk and the worst of silk will be the produce of them respectively. The katanies are fit to spin any class of silk, and would, if at liberty, spin silk that could not be beaten or be found fault with. The machinery and filatures are better than they were in former years, and easier worked. And the whole secret lies in the fact of managers wishing to make impossible quantities of good silk at impossible rates, and to a pernicious system of management that will only end when the older hands have brought ruin on the

business, have been compelled by that ruin to clear out, and new blood and a more reasonable and judicious routine of business has come in.

Why, Mr. Editor, when I tell you that in most of the filatures the scale of salary paid to katanies thirty years ago is still persisted in, you will easily understand how it is that the business is being ruined. Food, living, the value of money, and in fact almost every item of domestic economy, has undergone a change in Bengal, but the katanies' salaries, wherever the "antediluvians" have the power to carry it out with the strong hand, have remained in *statu quo*. Rice may sell at one rupee per maund, or five rupees per maund it makes no difference. Five rupees and four rupees they got respectively year out of mind, and that they must get, if not, how is silk to pay?

Again, as regards quality of silk. I have stated that the cocoons, when sorted and worked fairly, will yield silk of similar quality, in fact, as good silk as can be desired may be produced; but the cocoons are not sorted to make special classes of silk, and, as a rule, the spinners are bound to make only such a class of silk as pays, and they do it. Doubtless the managers want, and would like to have, the best of silk, but it does not pay to have the best of silk, and they take, with all sorts of make-believe of dissatisfaction, what they can get, and do their best after they have got it, to pin their faith to it, and pass it off as the best in quality that can be reeled.

You will say that my statement smacks of a paradox. Well, so it does, but nevertheless, it is true. The process by which the arrangement comes about requires explanation. To begin with every filature, as a rule, has a head native—the gomashta, who is responsible for all the money sent to the filature, the cocoons bought at or by the filature, the quantity and quality of silk made, and the losses incurred on cocoons with which the silk is made. There is an assistant, too, in each filature, or in charge of two, three, or more filatures, but he is a sort of "nonentity" kept to look after the general working, to draw commission on all the silk made, and to keep the natives in some sort of check. He is expected to see, too, that good silk is reeled. As the season opens, the money comes in from head-quarters for the purchase of cocoons, and with it an order or hint up to which each seer of silk will be paid for at head-quarters exclusive of reeling-expenses. Thus, if an order of Rs. 10 per seer is given, and a maund of cocoon yield three seers by estimation of silk, then the gomashta can pay Rs. 30 for that maund of cocoons.

Now, if the gomashta buys those cocoons for Rs. 30, and they yield only two seers of silk, he is Rs. 10 to the bad silk. There is the secret and actual reason why bad silk is made. The gomashta, being responsible, takes very good care that he obtains all the produce he can from the cocoons, and the spinners are told to work accordingly.

Here I must digress to point out that each cocoon contains as a covering a certain quantity of coarse, loosely put together, silk. This must be cleared off if a clean fibre is wanted. The clearing this flossy covering represents so much loss in produce of good raw silk, and the reeling off of some of it with the clean fibre is so much gain of produce, the gomashta elects for the latter. Well, where it is understood that the gomashta is bound in his own interests to obtain produce, it is very simple to follow up the reasoning, and the result or conclusion come to is that the kataníes as a rule are not permitted to work with the view of making the best silk possible, and therefore, not being free agents, they cannot be blamed for turning out bad silk.

Having shown what is the actual root and origin of bad silk, I will proceed to add that the system of checks at head-quarters to test the quality of silk is simply bad. The natives who carry out the testing are fearfully corrupt. I know a large concern—in fact, one of the largest concerns in Bengal—in which it is usual for the gomashtas to send money with each despatch or lot of silk, and provided a good amount accompanies the silk, no matter what the quality of the silk is, it passes as first class. The managers profess to know nothing of this, and this evil, being the outlet to work off the silk, resulting from produce, damns the whole business.

It may be urged that I am exaggerating, but such is not the case. I have seen silk not fit to be sent to market passed, and on the other hand, I have seen first-class silk reported on as bad, and all the native hands fined for it. The gomashtas naturally say what is the good of using produce and making good silk when one has to bribe to see it passed, just the same as is done for the bad silks.

It is easy to deduce from this that so long as filatures are managed under a system that centres all loss on the gomashta, no first class silk can be expected as a rule.

Of course there are exceptions to every rule, and the exception is this—when very good batches of cocoons happen to be bought, they seldom turn out bad silk off them. But in these cases too the assistant, unless he is very smart, is powerless, because the good cocoons are often mixed with the bad cocoons.

It will be asked that if it is in the interest of the gomashta to make bad silk, and all the gomashtas make bad silk, how is it that any good silk is made? Why, it is a continual "pull-devil-pull-baker" sort of a game. Managers and assistants now and then punish the men, and create a reign of terror for a few days, when a little good silk is made, then it gradually falls back to the old standard, and bad silk continues to be reeled.

To sum up. The demand for local consumption is now very great. In the villages, formerly only the rich men wore silken apparel; now coolies do so. The demand stimulates production, coarse threads are reeled for the weaver, the yield from cocoons of such thread is greater than as fine thread, and thus the natives carry off cocoons that to the European is prohibitive; the European outturn falls short, no one takes the trouble to probe the matter, and a general outcry is made of the silk industry dying off.

It would be very easy to follow up what I have written above, and to show how it is that the Europeans are gradually but most perseveringly putting an end to the carrying on of silk business so far as concerns their filatures. In a few years more they will have about a fifth of their filatures only at work, and those also will work about 4 to 6 months in the year, but I have no time to write more to-day, so will leave the matter for my next.

SILKWORM.

THE USES OF CHEMICAL ANALYSIS IN A PRACTICAL POINT OF VIEW.

TO THE EDITOR.

SIR,—In bygone ages when the science of chemistry was in its infant stage, analyses of soil or those of any other thing, in the material world, in civilized countries, and for practical purposes, were a mere something for the gratification of enquiring minds; because the then discoveries, in the science, were so few that the results *perforce* became very unsatisfactory, accurate finding out being then almost impossible. Again, in those days very few people had a knowledge of chemistry, and that knowledge was so very limited that its use, in practice, was a matter of question; hence agriculture and other cultivations, the arts and manufactures, medicine, house and other buildings, and various other things too numerous to detail here, had to be managed without the help of chemistry: and of course in very crude or imperfect, and unsatisfactory fashions. The time I here allude to embraces the primitive and dark ages. As, however, time rolled on and discoveries were made, things assumed different aspects; so that in the present time chemistry, in civilized countries, is considered absolutely necessary, because chemical manipulations have, practically, been found to be productive of the happiest results in multifarious ways. Chemistry, it should be noted, is a purely *experimental demonstrative science*. To elucidate the subject, I must say that the chemical constituents of (1) the solid food we eat; (2) the liquid food, such as milk, wines, spirits, beer, porter, various other beverages, and the water we drink: (3) the medicines, whether externally or internally, we use; (4) the ores we dig out of the ground; (5) the salts and earthy matters we extensively use in the arts and manufactures, also as food ingredients; (6) materials of dyeing; (7) the compounds of metals and minerals we use in the arts and manufactures; (8) the clay, sand, and stones we use as building materials for conversion into bricks, lime, and mortar and in pottery; (9) the soils in which plants grow; (10) the atmospheric air, manures, and irrigation waters which serve, in addition to the soil, as food for plants; (11) and lastly, though not the least, the plants themselves—are all required to be known, and known in most cases thoroughly, before we can decide their adaptability for special or general purposes, and fix their commercial or intrinsic and revenue value accordingly. What I have advanced, no one having his intellect sound, knowledge and education perfect

requiring much azote can less expensively be grown in India than in those countries. But the foregoing famous investigation by these distinguished and very high authoritative doctors, and other things mentioned above could not have been made without the help of chemical analyses, therefore its great practical use as respects soils of all kinds and depths, and for all manner of plant cultivations.

10. Chemical analysis of atmospheric air, the most tedious and time-absorbing in the whole range of analytical chemistry, is of a character which might be likened to the Director in whose hands are the destinies of the present and future races of *organic nature* of our planetary orb, *earth*. I will presently explain in which way air analysis assumes this most important character.

The component elements of the atmospheric air, it is well known, consists of *nitrogen*, *oxygen*, *hydrogen* and *carbonic acid* principally; and *chlorine*, *phosphoric acid*, and *sulphuric acid* in, comparatively speaking, insignificant quantities. These substances exist in the shape of gases and blended in different proportions or *volumes*; hence to use the words of Boussingault and Dumas the atmospheric air is a 'true mixture.' The properties of all these elements are also fully known to every one knowing anything of science. In organic nature an equilibrium, termed by the distinguished chemists and physiologists whose names have been cited, 'balance,' is maintained This balance is the source of life to plants and animals of all kinds and in all places, dry land and water; but it cannot be always maintained, its breakage, in the physical world, being already threatened by the very rapid increase of human beings and animals of all kinds subserving the purposes of man, besides these in a wild state not yet extirpated, also plants of numerous kinds to supply food and other wants of man and animals subject to man. All these are constantly robbing the air of its moderating element—*nitrogen*, for such is the real character of this element, and since the processes of *evolution* and *involution* are disengaging only a very small fraction of what nitrogen element they are storing in their structures, the *balance of organic nature* cannot hold out long, but, sooner or later, must break up by the paucity of nitrogen in the air. The very moment this takes place, the all-powerful life-maintaining and at the same time life-destroying *oxygen* gas will break asunder its present mildness, become violent and burst out in flames. When this takes place universal lightnings (violent electric sparks), thunders of the most virulent character, cyclones, probably at the beginning hail and rain also, and earthquakes, on account of nature following the laws of gravitation discovered by Sir Isaac Newton, and cohesion, will take place; and gradually, by immense physical changes which will then take place, the planet earth will be enveloped by one uninterrupted mass of flames, whereby the whole animated nature including plants, will be burnt up, not a single human being will be found living. All the waters on the earth, such as seas, oceans, lakes, rivers and wells, will boil and partially or wholly be dissipated like water in a cauldron does when placed on fire, consequently fishes and other animals living in water will perish, and then the bible prophesies quoted below will be fulfilled to the very letter.

'But the day of the Lord will come as a thief in the night, in the which the heavens shall pass away with a great noise, and the elements shall melt with fervent heat, the earth also and the works that are therein shall be turned up.' II Pet. III, 10.

'And great earthquakes shall be in divers places, and famines and pestilences: and fearful sights and great signs shall there be from heaven.'—St. Luke XXXI, 11.

'Immediately after the tribulation of those days shall the sun be darkened, and the moon shall not give her light, and the stars shall fall from heaven, and the powers of heaven shall be shaken.'—Math. XXIV, 29.

Other passages in the New and Old Testaments might also be referred, which exactly tally with science and the Scriptures, and it do not vary to the very letter.

The uses of chemical analysis of air consists in the data it can furnish from time to time, regarding the proportion of the gases in the atmospheric air on which to base scientific and political measures for, at least, prolonging the inevitable prophesied destruction.

The manures and irrigation waters, because supplying plant-food ingredients, also require to be analysed.

II.—The chemical analyses of plants are very important, both for gaining the necessary knowledge for growing them, and for what uses they are adapted.

The inference of the whole said above at once brings home to the minds of the most superfluous thinker the great importance of chemical analysis in a practical point of view.

Some people advance that various results are obtained in analysis. To them I say, efficient analysis always does its work admirably and can trace down to *one millionth part of a grain*, which *datum* certainly is quite enough for all practical purposes. It is true, various analytical methods exist giving various results; in reality, however, there is but one method for such analysis, and the sooner this method, which must be the most approved one, is agreed upon, by chemists, the better for progress. The most approved method consisting in the most approved way adopted, chemicals and apparatus used in the particular chemical manipulation (analysis). To my mind all chemists and chemical societies in all parts of the world, ought to arrive at this all-important decision, the sooner the better.

O. L. BRYCE.

Bahraich, March 12, 1883.

The Indian Agriculturist.

CALCUTTA, APRIL 2, 1883.

FUEL AND FODDER RESERVES.

IN the supplement to the *Gazette of India* for the 10th March, there is a very important resolution on the conservation of grazing lands and wooded tracts, especially in the provinces of the Punjab, the North-West, and the Central Provinces, including the Berars, which we reproduce elsewhere, and to which we desire to draw the attention of our readers. It is perfectly clear to those who have studied the agricultural condition of India, that some such measure as that proposed in the resolution is becoming year by year more imperative. The rapid increase of population following from the peaceful rule of England which has reduced to a minimum loss of life from war, pestilence and famine—those natural checks to the growth of population, coupled with the hitherto all but insurmountable repugnance on the part of the bulk of the Indian peasantry to any scheme of emigration on a large scale—make it imperative that jungle land should be cleared for grazing purposes and the latter in turn utilized for arable land in larger and still larger areas year by year. The pressure of the population on certain areas in India renders the struggle for existence more and more keen, and in this struggle, it is very evident that ignorance, want of thrift and foresight, as well as poverty and the hereditary apathy of the Indian peasant, have worked mischief to the land and its power of producing fodder, fuel, and food, which, though not irreparable, has in Upper India and elsewhere produced conditions which render it impossible, should a single monsoon fail, to keep alive the plough cattle, and which even imperil the lives of the cultivators. We do not believe that it is possible with such a peasantry as that of India, or indeed any peasantry mainly dependant for existence on the safe gathering of almost a single crop, to do more with one generation, at least, than render their lot a little less hard. Habits, methods and idiosyncracies crystallised and hardened beyond any hope of remoulding, as well as tribal and race characteristics ingrained in the web and woof of the people's lives, render change and innovation all but impossible with those who have reached middle life, while even with the rising generation a fresh set of conditions and surroundings, broader ideas and newer methods are but things of slow growth.

Nevertheless, as we have said, some little may be done to render their lot less hard, to stave off impending calamities, and to avert evils which ignorance, poverty, and thoughtlessness have already produced and are producing; and it is in this direction that the Agricultural Department will find, in our estimation, the widest and the truest scope for its usefulness. The resolution above noted proposes to maintain throughout the plains of Upper India a supply of wood for fuel and domestic purposes, as well as of fodder for cattle in times of scarcity, or rather we should say, fodder resources are the object chiefly aimed at, in the securing of which a supply of fuel will also be obtained. The plan proposed is that the Forest Department should be consulted regarding the best means of bringing waste lands into a condition suitable for the purposes aimed at; that certain areas should be enclosed to prevent the destructive grazing of goats and cattle, and supply fuel and food in times of need, and in this way to restore, and if possible increase, the usefulness of land which is fast decreasing, or has already been practically lost. The advice and co-operation of Local Governments is asked regarding the form in which system and continuity can be most advantageously established. The whole details of the practical working of the scheme are, it will thus be seen, wisely left untouched until such time as the various officers who may be supposed to have an intimate knowledge of the localities, and the various matters implied in such an undertaking, have recorded their opinions and experience. At its present stage, then, all we desire to do is to commend the wisdom of the proposal, and to hope that the department from which it emanated will be able in a few years to say that in the districts where fuel and fodder reserves have been established loss of cattle to any great extent is rare, that land previously waste and comparatively useless, has been covered with forest and grazing grounds, and that the peasantry of these districts is thriftier, healthier, and more prosperous than those in less favoured districts.

IRRIGATION IN BENGAL.

THE Revenue Report of the Public Works Department, Irrigation Branch, Bengal, for the year 1881-82, has been published. It shows that the capital invested in irrigation works in Bengal (direct charges), up to the end of the year under notice, amounted to Rs. 5,48,10,043. This was divided as follows:—

	Rs.
Productive Public Works	5,24,57,980
Imperial Ordinary Works	8,30,624
Provincial Works ...	15,21,439

The results of the operations during the year show a deficit of Rs. 19,22,213 (this includes interest and all indirect charges), against Rs. 23,06,111 in 1880-81, or excluding interest, but including all indirect charges, a profit of Rs. 1,52,975, against a loss of Rs. 31,353 in the previous year. This comparatively favourable result is partially due to the rate of interest payable to the Supreme Government on works executed from loan funds having been reduced from 4½ to 4 per cent, but it is also largely owing to increased receipts from the Sone canals. The net receipts for the year from the Western Main series of the Sone project—the capital expenditure on which has been Rs. 1,59,92,879—were Rs. 2,76,564, against interest charges amounting to Rs. 6,04,022; so that on parts of the irrigation works, the returns have begun to bear a very appreciable ratio to the burden they caused to the provincial finances.

The collections in Midnapore and Orissa were not satisfactory, mainly owing to the low prices for rice, which continued to prevail. It is stated that since the close of the year under review considerable progress has been made in realizing the arrears in Orissa, but in Midnapore the difficulties which impeded collections are only just beginning to be surmounted. The Chief Engineer adverts at length to certain cases in which the collection establishments in this district were charged with oppressive acts in realising the water-rates due. The matter was brought to the personal notice of the Lieutenant-Governor when on tour, and a searching enquiry by the Collector and Superintending Engineer followed. The allegations made were completely disproved; but in the meantime collections almost ceased, and low prices, the prevalence of malarious fever, and the time taken up in issuing leases in place of those which expired, have militated against the realization of the arrears which had accumulated. The system which was last year introduced in Shahabad, under which an experienced Deputy Collector was placed in direct charge of the collecting department, has been specially successful, having received much personal attention and supervision from the Collector of the district: the amount received during the year for water-rates was Rs. 5,30,706, against Rs. 3,09,980 in the year preceding, and for the first time since irrigation operations were commenced, there is a decrease in the balance remaining to be collected at the close of the year.

During the year under review the working expenses, direct and indirect, amounted to Rs. 11,03,834, against Rs. 10,50,728 in 1880-81. The excess is wholly in Orissa and Midnapore, there having been a decrease of Rs. 14,015 in the charges on account of the Sone canals. Heavy floods in Orissa, which necessitated special repairs to the embankments on the Byturnee river, and large expenditure on the dredging plant used on the Midnapore canal, were the chief causes of the increase. There was a decrease in the total irrigated area, and this occurred wholly in Behar. The falling-off in the area watered by the Sone canals may for the most part be ascribed to seasonable rainfall, which, to quote the report, was 6·17 inches in the kharif season, and 4·11 inches in the rubbi season, more than in the previous year. The decine in rubbi irrigation is, however, partially due to the substitution of kharif for rubbi crops wherever irrigation can be secured, and is observable, though in a less degree, in Orissa.

The navigation receipts of the year amounted to Rs. 3,42,876, and thus exhibits an excess of Rs. 63,892 over that preceding. This increase occurs chiefly in the receipts from the canals comprising the Sone project, but with the exception of the tidal canal, there has been development everywhere. The receipts from the transport service, which are included in the above figures, reached Rs. 91,606, against Rs. 67,387 in 1880-81. It is contemplated to gradually transfer this service to private enterprise, and a beginning has already been made, the Calcutta Steam Navigation Company having, from the 1st January of the current year, taken over the steamers on the Midnapore canal. The results of the year's working are the most successful yet experienced, and though up to the present time irrigation works have failed to defray the charges for interest payable to the Government of India, the returns are increasing, and warrant the expectation that eventually the Orissa and Sone canals will cease to be a burden to the province. Estimates for extending the distributary system in Orissa have been submitted to the Government of India, and as at present 106 of the 214 miles of canal in that province are absolutely without any means of distributing the water they carry over the country they are supposed to irrigate; it is hoped that sanction will not be withheld. If accorded, it may reasonably be expected that the new distributaries will be as successful as those now existing, in which case the receipts will suffice to cover the interest charges on the entire capital expended.

The Sone canals require time to develope; the largest proportion of the revenue is at present derived from the Arrah canal and its branches, and it is thought that there is no reason why irrigation should not become equally developed on the remaining branches as their advantage becomes better known.

THE FOREST ADMINISTRATION OF BRITISH BURMAH.

THE Chief Commissioner's resolution on the Forest administration of British Burmah for the year 1881-82 testifies that excellent work was done by the department during that period.

The area of reserved forest was increased by 836 square miles, making the total reserved area stand at 2,876 square miles at the end of the year, which is distributed between

the Pegu and Tennasserim circles in the proportion of 2,440 square miles to the former, and 436 square miles to the latter. With the exception of 47 square miles reserved in the Tenasserim circle, the work of reservation during the period under notice appears to have been entirely confined to the Pegu circle. The new reserves were the Mindome Yoma and the Yaythe in the Prome division, the Upper and Lower Tramayee in the Rangoon division, and the Kyoukewasin and Saing in the Toungoo division. The work of reservation is said to be far advanced now, chiefly in the Pegu circle, where it is considered to be completed on the west slope of the Pegu Yowa. In both the Pegu and Tenasserim circles further tracts have been examined in view to declaring them reserved forests. The local administration considers that the reservation of forests has been most successfully carried out, and that the officers employed on forest demarcation have been very careful in ascertaining and examining the claims of those interested in the forests proposed for reservation. Every consideration appears to have been shown to the villagers whenever their removal has been rendered necessary, and they have been allowed to move at their convenience, ample compensation being also granted to them for the trouble involved in shifting their dwellings.

Of the total area of 115,982 acres under protection from fire, only 1,906 acres were burnt during the year. In 1880-81, 19,363 acres were burnt out of 96,218 acres under protection, the area actually protected being only 76,858 acres. The improvement in the year under notice is therefore very noticeable, but although the area protected is so much larger than in 1880-81, the cost of protection has only increased by Rs. 780. The average cost per acre of successful protection was one anna seven pies, against two annas two pies in the previous year. There were fifteen fires during the year; most of them are believed to have been due to accidental causes, though several are also attributed to incendiarism, some for the purpose of driving game out of the forest, and others from purely malicious and mischievous motives.

The progress made in teak planting does not appear to have been very great. The total area under teak at the close of the year was 8,000 acres, against 7,131 at the end of 1880-81, or an increase of 869 acres. The planting operations are being conducted now on the toungya system, the entire area of teak toungyas at the end of 1881-82 was 4,439 acres, costing on an average about Rs. 9-13-11 per acre. The system is said to be succeeding admirably, the greater portion of the areas on which it has been tried is now stocked well with healthy seedlings, and every advantage is being taken for promoting the system. An interesting experiment was made in the Pegu circle in the Bwet and Nyanleh reserves in toungya teak planting in areas where the bamboo has flowered. The course adopted is to burn the flowering bamboos and plant up the area so burnt over with teak seedlings transplanted from nurseries. An area of 450 acres was planted in this manner during the year, and the results have been very successful. Further operations on this system are to be tried during the current year. The results of the experimental cultivation of exotic trees at Mergui and Tharrawaddy have been on the whole successful. The plants of the *Pana*, India-rubber tree, and the *Ceare* trees are said to be growing well at Mergui, while such of the mahogany plants in Mergui and Amherst as have escaped the attacks of insects are making excellent growth. The cinchona plantation at Thandoung has not hitherto promised well, and that at Pyoonchoung has done so poorly that orders have been given to abandon further outlay on the experiment there. The local administration is desirous of obtaining the advice of an expert as to what should be done to secure greater success, and it is hoped that Dr. King will be able to visit Burmah shortly, if his services can be spared by the Bengal Government.

In the account under girdling operations, we see that 24,409 trees were girdled during the year, at a cost of Rs. 6,310. During the coming season it is believed that about 11,000 teak trees will be girdled, and it is estimated that there will then remain about 26,000 to 30,000 trees, the girdling of which will extend over two years.

The total revenue of the Department amounted to Rs. 22,31,804, as against Rs. 15,16,613 in 1880-81, or an increase of Rs. 7,15,191. The large increase has occurred in timber and other produce removed from the forests by Government agency. The total number and quantity of logs and pieces of timber of all kinds extracted by Government agency during the past two years were :—

	Number of logs and pieces.	Quantity, Tons.
1880-81	35,487	18,910
1881-82	198,739	50,517
Increase ...	1,63,252	31,607

Of this timber 43,630 logs and pieces, and 28,615 tons were teak. The extraction and utilization of other timbers than teak is now being largely taken to, a course which is viewed with great satisfaction by the local administration as likely to help to expand the business. Owing to the decline in the production of cutch, there has been a large falling-off in the receipts under the head of "minor forest produce." There were only 2,611 cauldrons at work during the year, as against 7,275 cauldrons in 1880-81, and the amount realised for permits to manufacture cutch was Rs. 48,486 against Rs. 81,066 in the year preceding. The decrease we observe is attributed to the fact that the cutch supply outside reserves is nearly exhausted.

The total expenditure of the year amounted to Rs. 11,50,223 against Rs. 7,12,568 in 1880-81, the increase being principally due to the enhanced cost of extraction of timber by Government agency, owing to the larger quantity brought out of the forests.

UTILIZATION OF SEWAGE.

So much has been said and written on this great social problem by physicians, sanitarians, political economists, and scientific agriculturists of eminence, that it is scarcely possible to moot the subject without trenching on previously published opinions. The late revelations, however, concerning the state of the Calcutta sewers by Mr. Thomas Jones, renders necessary a clearer comprehension of the laws of hygiene than can be gained by a study of the logic of disturbed municipal functionaries, who object, it appears, to learn through exact observation and examination the cause of deficiencies made palpable by their very vileness. We have already learnt enough to know what gave origin to the December stenches, accounted for then by the horse-droppings and other theories, in the absence of easily accessible and since ascertained conditions. These conditions brought to light by Mr. Jones point to some defect in the construction of our sewers, or neglect on the part of those responsible for their control, and to the surmise that for some time past these sewers have, instead of contributing to our health and comfort, been converted into active generators of zymot i poisons. Sewers are considered by some to be the perfection of sanitary skill, and we are far from disputing their value, when properly worked, for we have exact statistic data to show that wherever they have been introduced and rigidly looked afte r epidemics have ceased. But we have seen, not in this country alone, that we cannot safely rely on having the ideas of the projectors of these works carried out; that consequently it becomes a matter of importance to seek for additional measures to meet conditions which, under similar circumstances to those locally revealed, might again occur. To secure such measures we must put aside all question of expense until such time as complete safety has been provided for, when it will be our duty to consider whether, by the utilization of the waste organic matters operated on, we can recoup either wholly or in part the money spent. In order, therefore, that our judgment may be facilitated respecting such extra measures, it becomes necessary to shortly refer to those in use in European cities. We allude of course to the various precipitation processes in operation at London, Liverpool, Leicester, Birmingham, Bradford, Coventry, Tottenham, Swindon, and other places, one or two examples of which taken from papers by David Forbes, F.R.S., and Dr. Wallace of Glasgow, will enable us to comprehend at a glance the idea governing them, as well as inform us of their cost and value. "Among the towns where precipitation is in use," says Dr. Wallace, "none is more worthy of attention than Leicester, the population of which is about 120,000, while the sewage amounts to 7,000,000 gallons per day. The quantity of lime used is 20 or 30 cwts. per

million gallons, *and nothing is obtained for the sludge*, which has hitherto been employed, almost exclusively, in making up land in the immediate neighbourhood of the works. The cost of working, for lime, fuel, and labour, is £2,200 per annum. The whole of the sewage requires to be pumped 26 feet. The precipitation is effected in a series of very large tanks and settling ponds, and and the effluent is further purified by filtration through an osier bed three acres in extent. Coventry has been working for some years Dr. Anderson's patent in which sulphate of alumina, with enough lime to throw down the alumina, is employed. This latter process yields a sludge having three times the phosphatic value of that precipitated by lime alone. "Whatever system," continues Dr. Wallace, "of precipitation is adopted, the disposal of the sludge is one of the most important elements in the calculation of the cost." This is a question, however, which we think in a place like Calcutta will be easily met. Against the statement by Dr. Wallace concerning Leicester, that nothing is obtained for the sludge, we have a report by Dr. Augustus Voelcker, Consulting Chemist to the Royal Agricultural Society, on precipitated London sewage ; it is addressed to A. P. Price, and quoted by David Forbes, F.R.S., as follows :—

"The following is the composition of the sewage deposit which you desired me to analyse :—

100 parts of the dry sewage deposit contain moisture, loss in drying at 212°F.	3·98
* Organic matter and water of combination ...	20·11
† Phosphoric acid	28·52
Lime	13·09
Alumina, and oxide of iron, and a little magnesia and alkaline salts	
Insoluble siliceous matter	
	100·00

* Containing nitrogen 0·57, equal to ammonia 0·69.
† Equal to tribasic phosphate of lime 62·26.

The whole of the phosphoric acid, I may state, occurs in this manure in the shape of precipitated phosphates, a form I need hardly say in which the phosphates are readily available by plants. The presence of a large amount of water of combination in the deposit, that is, water which is not expelled on drying at the boiling point of water, shows that the phosphates with which the water enters into chemical combination, and which does not escape at 212° F., are not likely to return readily into the ordinary and, comparatively speaking, ineffective condition in which they exist in phosphatic minerals. Being obtained by precipitation from their solution, the phosphates are present in the deposit in a very efficacious form. * * * It possesses valuable fertilizing properties, and in my opinion a sewage manure, equal to the sample analysed by me, will command a ready sale at £7-7 per ton. Believe me, yours faithfully,

(Sd.) AUGUSTUS VOELCKER.

According to Forbes, the estimate of value here given is due in a great measure to added phosphates, crude phosphate of alumina being used as the precipitant ; about £2-10, however, per ton, would be the value of the material recovered. It is, therefore, reasonable to suppose that a manure representing even one-fourth the percentage of phosphates noted, would command a ready sale at Calcutta. The purifying action of these precipitants is due, says Forbes, and as we ourselves well know, to the chemical reaction between the alumina salts, and the organic matter in the sewage, by which compounds are formed, especially with the nitrogenous or albuminoid constituents, more or less insoluble in water. Putrefaction is thus checked, and the evolution of foul gases carrying into the atmosphere we breathe the germs of cholera, typhoid, and small-pox rendered impossible. We cannot pursue our reflections on this subject without a whole train of thoughts occurring to us, and the germ theory of disease—no longer a theory in our opinion—is that which forces itself upon us at every turn. As it appears that certain municipal functionaries are inclined to disregard the opinion of authorities on this point, it may be well to quote Tyndal at this place. "Let me state," says that philosopher, "in two sentences the grounds on which the supporters of the germ theory rely. From their respective viruses you may plant typhoid fever, scarlatina, or small-pox. What is the crop that will arise from this husbandry ? As surely as a thistle rises from a thistle seed, as surely as a fig comes from the fig, the grape from the grape, and the thorn from the thorn, so surely does the typhoid virus increase and multiply into typhoid fever, the scarlatina virus into scarlatina, and the small-pox virus into small-pox." Putrescent sewage matter is the soil in which zymic *infusoria* abound. Since then there is every reason to believe that these fermentative organisms can transform themselves under peculiar conditions into different ferments, which, fructifying in this soil, yield germs endowed with distinct poisonous properties, the idea of destroying the chance of their evolution in the first stage, becomes of vast importance. Water, according to David Forbes, Dr. Wallace and others, has *per se* no purifying action whatever ; it merely acts as a diluent, and serves to carry out the first principle of sewage engineering, *viz.*, the rapid disposal of fæcal matter, into the nearest tidal river or to some centre where sewage irrigation is practised. Here another thought of importance occurs. Some sanitarian has said that by the former means of disposal, we pollute our streams to such an extent that they can no longer furnish water fit for either man or beast to drink, or fishes to live in. Happily in Calcutta our great arterial drain, the Hooghly, offshoot of the holy Ganges, is not utilized for this purpose. It appears, however, no less certain, in the abscence of special protective measures, that wherever the city sewage is conveyed, its properties and effects are not altered. Discharged as it is into the salt lakes, some miles beyond the city, and thence as supposed into the Bydiadurree, a tidal stream, we conclude that the effects and influences of saline matter, the atmosphere, tide and current, must render it innocuous. Are we, however, satisfied that this is the case ? We must admit of course that the matter is rendered, so far as we in Calcutta are concerned, inoffensive, but we may have wafted back to us, when south-easterly winds prevail, disease germs of varied potency, which indeed, the characteristic unhealthiness of the intervening suburbs points to. The closer, in fact, we examine the question, it will appear that we cannot purchase safety at a cheaper rate than the people of Coventry and Leicester. We have seen that the defecated sewage of these towns is rich in all the elements essential to plant growth ; that it is further of a compact nature, and may be used for raising the land. Why, then, in the case of Calcutta, where a natural impulse urges us to save it for agriculture on the one hand, and for our better protection from the action of tidal waves on the other, should we not venture upon this second, and evidently conclusive, step in sanitation ? We know that every grain of wheat, every grain of rice, and other seeds, every chest of tea and indigo, every bale of cinchona and numerous other products which leave the country contribute year by year to the exhaustion of the soil. This is an oft-told tale, but it cannot be too often conveyed to the native mind, and to the minds of European settlers who have large interests at stake. This sewage precipitate is the manure *par excellence* for indigo, by reason of the large amount of ammoniacal matter it contains, and for wheat and tea, by reason of its richness in phosphates. The demand for such substances, however, must be created. The obvious duty, therefore, of the Calcutta municipality, if they think fit to adopt any of these additional methods for the prevention of the putrefaction of waste organic matter, is to do so, at first, without hope of profit. That such measures are necessary there can be no question, especially since the president of the Calcutta Council maintains that undulatory strata of almost concrete sewage, varying from six to eighteen inches, does not retard the flow of matter, and the desired accelerative action of the tide. Putting aside altogether this argument, which we might make much of, and bearing in mind simply that this concrete matter—itself putrescible—forms a series of cesspools wherein recent fæcal matter becomes deposited, ferments and fills the drain with deadly gases of greater tension than the superincumbent atmosphere, we must instinctively admit, not alone from their very palpableness, that such vapours find their way by perhaps a thousand different outlets, into the atmosphere, and that if we do not die, it is because fate keeps us without the zones within which zymotic germs find egress. It does not fall within our province

to point out which method of sewage irrigation or precipitation would be most applicable to Calcutta, but we venture to suggest a means of its profitable disposal when so treated, and we do so, bearing in mind the wish of the present Government to raise the native to a better estimation of himself; and in doing this we need but refer to Akbar's instructions to his collectors of revenue with regard to agriculture, which were as follows:—

"The collector must consider himself the immediate friend of the husbandman, be diligent in business, and a strict observor of the truth, being the representative of the chief magistrate. He must transact his business in a place to which veryone may find easy access, without requiring any go-between . . . . . His conduct must be such as to give no cause for complaint. He must assist the needy husbandman with loans of money, and receive payment at distant and convenient periods. When any village is cultivated to the highest degree of perfection, by the skilful management of the head thereof, there shall be bestowed upon him half a biswah out of every biggah of land, or some other reward proportionate to his merit. Let him learn the character of every husbandman, and be the immediate protector of that class of subjects. Let him promote the cultivation of such articles as will produce general benefit and utility, with a view to which he may allow some remission from the general rate of collection. In every instance he must endeavour to act to the satisfaction of the husbandman." This quotation, we think, renders our plan at once obvious. Let the Government purchase the Municipal produce, insist on its use, and recoup themselves at distant and convenient periods by imposing a slight tax on the calculated increase of produce, keeping in mind, however, at the same time, the principles laid down by Akbar. They will thus in a simple way conduce in a great degree to the spread of agricultural knowledge, and prevent the inhabitants of large towns being overtaxed to insure life, when, as it is, they are heavily burdened. They will contribute to a reduction in the price of food-stuffs, by promoting their increase, and so, to contentment. Above all, they will contribute to their own safety—for zymotic germs are no respectors of persons.

EDITORIAL NOTES.

FROM the report of the experimental farm at Bhadgaon for the half-year ending December last, we observe that the area cultivated with cotton was 210 acres, or an excess of 58 acres over the area of the preceding year. Notwithstanding the excessive rainfall of the season which injured some of the crops, the out-turn is good on the whole, the average yield of clean cotton being estimated at 200lbs. per acre. In regard to the prospects of cotton in the district, Mr. Stormont, the superintendent of the farm, thinks that the produce will be equal to that of the year preceding in quantity, and considerably superior in quality, owing to the almost entire absence of the Waradi or Deahi variety, which is now scarcely cultivated anywhere in the district. From the results of his experiments with a new cotton, which was believed to be a hybrid, though subsequently it was proved that the plant was no hybrid at all, Mr. Stormont concludes that a crop or plant of any kind may be readily and largely developed and modified by cultivation. The plant in question was sown under varied conditions, in rich garden ground, on medium land, and in a poor cotton field; and with the results that, under the first, it maintained its peculiar character, the second was irregular and below average, while the third failed entirely.

The area under *bajri* and *jowari* was 106 acres: the abundant rainfall of the season was highly beneficial to both crops, and the yield would doubtless have been large, were it not for the damage done by locusts, by whose ravages half the entire crop was destroyed. The cultivation of wheat was also, we see, more extensively carried out during the period under report, and the crop promised to turn out well. Consignments of the farm wheat have, we observe, been sent to British Burmah and Mysore for cultivation. In Burmah, it is said that it is intended to attempt its cultivation in lands which are rendered unfit for paddy cultivation, owing to their being inundated during the rains. The cultivation of the early amber-cane has also been attended with success, the *jagree* and treacle manufactured from it is said to be of superior quality, and the latter is to be utilized for making candy sugar, for which purpose it is believed to be suitable.

We see that the exhibition of farm bulls at the recent agricultural show at Ahmednugger has resulted in a demand for superior animals in that district, and some animals are now being sold at prices ranging from Rs. 100 to Rs. 125 each. A two-score flock of Dumba sheep was also added to the live-stock of the farm during the half-year, but from the experience already derived in the breeding operations carried on, on the farm, the superintendent does not think that animals of pure blood will take to the climate. The cross between the country ewe and Dumba ram has, however, it is said a good constitution, and retains to a large extent the fineness of wool of the pure Dumba.

We observe it mentioned that the employment of saw-gins for cotton-cleaning has, through the experiments shown on the farm of their effectiveness for this purpose, found much favor amongst private firms and companies.

IN one district of India alone, half the cattle, or 250,000 head, died from starvation in 1877. Disasters of this sort have resulted from an increase of the population, which advances further and further into the jungle, bringing into cultivati[illegible]ltivable waste land, which formerly served the purpo[illegible]village grazing grounds. Precisely the same encroachments occur in Europe from the same cause—that of increasing numbers. But owing to the greater constancy of the weather in temporate climates, the effects there are not serious. In such places, compensation for the lost grazing ground is found in the increase of cultivated fodder crops, upon which reliance can be placed from year to year. But in India, things are different. In unirrigated tracts—that is, over a very large part of the country—if droughts occur, and we know that they do so periodically, the fodder crops wither and die, and the cattle, having no longer any jungle to which to turn, perish miserably. The Government of India is therefore setting itself to work to remedy this state of things, by protecting and enclosing forest grazing lands. This will serve a double purpose. The long-rooted grasses deriving a supply of moisture from below, and the shallow grasses protected by shade above, will then furnish food for cattle, while the bushes and smaller trees will reproduce themselves by seeding, and provide fuel. Something has already been done in this way in Ajmere; and the results, after five years only, are said to be most encouraging, the appearance of the hills and countryside being quite altered. Averse as the villagers must be at the outset to a proceeding which encloses even a portion of their grazing lands for a time, they come to see the advantages of it when drought is upon them, and will, no doubt, before many years have passed, be allies, instead of opponents, of a measure designed solely for their benefit.

In Ajmere, side by side lie protected fodder reserves and unprotected jungle, and the difference is most striking, though the enclosures have existed so short a time. "The first are covered with an almost impenetrable thicket, chiefly composed of shoots edible by cattle. The second are practically devoid of all vegetation, and appear to be mere heaps of rock and stone."

ONE of the changes resulting from the reconstruction of the Madras Agricultural Department is the retirement from the service of Mr. K. Schiffmayer, Assistant Superintendent of Government Farms. Mr. Schiffmayer is a graduate of two German Agricultural Colleges, and a pupil of the late Baron Liebig, whose lectures he attended when a student of the Royal Polytechnic, and of the University of Munich. Mr. Schiffmayer came out to India in 1873. He was especially engaged with the view of being employed in connection with district farms, the establishment of which was then under consideration. District farms having never been opened, the services of Mr. Schiffmayer were utilized on the Saidapet Farm and the Agricultural College of that

place. When engaged in the chemical laboratory, he was seriously injured by an explosion of chemicals, which led eventually to his retirement. Mr. Schiffmayer possesses a farm near Bangalore, and intends, after having recruited his health, to use the same as an experimental and acclimatisation station.

A supply of 62lb of Carob seed was received from the Director of the Department of Agriculture and Commerce, North-Western Provinces and Oudh, in the month of August, and was sent to the Divisional Commissioners and Conservators of Forests in the Bombay Presidency for distribution among the District Collectors and Forest Officers for cultivation in localities where it was likely to succeed. Reports regarding the result of the experiments were called for, and have been received by the Bombay Government; and the following is the general results of experiments:—

The Acting Conservator of Forests in Sind reports that the Carob seed sent to him was distributed amongst the District Forest Officers; that experiments made with it in the Sukkur circle in Rahuja nursery have failed; that another trial was also made in the Sonda nursery in the Jerruck circle, where, on 31st July 1881, about 11 tolas of the seed were sown broadcast; and again, on the 5th October, 14 tolas more were similarly sown; that of the July sowing only 9 seeds germinated, but the August lot produced a considerable number of plants, of which 66 have survived; and that the 9 July seedlings have reached heights of 33, 33, 22, 20, 16, 14, 11½, 9, and 8½ inches, and the August plants vary from 1 to 14 inches, but the greater number stand from 5 to 8 inches. The Conservator states that all the plants were protected by mats from the frost during the cold season, and adds that, when once these plants have established themselves in the soil and have sent their roots deep enough to reach the lowest level to which the moisture sinks when the floods subside, they should be able to exist without artificial irrigation or protection; and that at present they are too small, and he thinks it would be premature to express an opinion as to their flourishing in Sind or not.

The Superintendent of the Economic Garden at Hyderabad reports that two-thirds of the Carob seeds received by him was sown in pots on the 28th October 1881. The seed came up well, but a great number of the young seedlings were lost on account of his having (for want of small pots) to transplant them at once from the seed pots into nursery lines. Only 45 plants remain alive; they are quite healthy, but the largest plant is only about 7½ inches high. The remainder of the seed was sown on the 7th July 1882, and is beginning to show signs of germinating. Mr. Strachan states that he has tried this plant twice since the garden was shifted from Salaru to near Hyderabad, and five or six different times at Salaru both in seed-beds and in pots, and has found the latter plan most successful, and adds that, so far as the suitability of Carob to the soil and climate of Hyderabad is concerned, it will grow, but the slowness of its growth will prevent its being of much use except as an ornamental shrub in gardens, and the cost of rearing a plantation of Carob in Sind would be very great.

In submitting Mr. Strachan's report, the Commissioner in Sind observes that the results of the experiments tried at different times with Carob seed in Sind seem clearly to show it is not likely to grow well in that province, or be successful as a tree for purposes of trade.

The experiment has proved somewhat successful in "Rutnagiri and Kanara. It has been a complete failure in Kaladgi, and the report for Belgaum is also discouraging. It will probably succeed fairly in the moist climate of the Ghaut and Konkan Districts, Rutnagiri, and Kanara."

The Conservator of Forests, Northern Division, submits reports from the District Forest Officers of North Thana, South Thana, Khandesh, Nasik, Ahmednugger, Poona, Satara, Sholapore, Surat, and Panch Mahals, from which it appears that the experiments made by these officers in the cultivation of the seed generally failed except at Satara, where almost all the seed sown in pots germinated, the young plants being now healthy and about nine inches to one foot high, and at Sholapore where the seed sown resulted in 25 healthy seedlings, which are now one inch high.

The Conservator of Forests, Southern Division, reports that the experiments made in his division have proved utter failures everywhere except in Belgaum, where better results were obtained, and where there are 312 seedlings now remaining of an average height of four inches, but what effect the late heavy rains have had on them remains to be seen.

The report from the Manager of the India-Rubber Works Company, Silvertown, Essex, upon samples of rubber obtained from trees of *Hevea brasiliensis* and *Castilloa elastica*, growing in the experimental garden at Heveratgoda in October 1882, and sent by the director, Ceylon Botanic Garden, to Kew for transmission to Messrs. Silver and Company, is a very satisfactory one.

As far as quality is concerned, the caoutchouc produced in Ceylon by the three species of South American rubber-trees introduced by the Indian Government in 1876-77, is in all respects fully equal to that collected from the wild trees in their native districts.

Hevea Rubber.—As far as chemical examination goes, this rubber differs in no respect from the better description of Para bottle rubber, except perhaps in having a little more water imprisoned in it than is usual with well-seasoned Para. The method of preparation, as each layer in Para bottle rubber is partially dried when held over the fire as practised in Para, may explain this. A portion of this rubber well washed and dried gave a loss of 16·7 per cent. The amount of ash obtained on incinerating a portion of the unwashed sample is 0·7 per cent, which is about one-half that from the Brazilian product. There is a great similarity in the composition of the ash of the Hevea and the Para bottle rubber. The ash from the washed and dried Hevea is 0·6 per cent. This sample is almost entirely free from extraneous matter. On digestion in alcohol it yields only a slight coloration. Like Para rubber, its fresh-cut surfaces show a slight acid re-action, easily removed by washing. The washed product is free from taste and smell, and turns a dark colour on drying similar to ordinary Para rubber. As far as can be determined on so small a sample, there is reason to believe that as regards strength and elasticity, it would be fully equally to good Para India-rubber.

When mixed with the suitable proportion of sulphur and vulcanized, it possesses great strength and elasticity.

Castilloa Rubber.—On washing and drying a portion of this sample the loss is 12·3 per cent, so it is necessary to use warm water in washing this rubber; it becomes, on drying, much darker and shorter than para rubber. It has a bitter taste, which is not removed on washing. The unwashed sample yields 1·9 per cent ash; the washed sample gives 1·2 per cent. The shortness of this rubber would restrict its use to some slight extent where tensile strength or tenacity is required. When mixed with the usual proportion of sulphur and heated, it vulcanizes well, but imperfectly, and is devoid of strength, characteristic of the better kinds of rubber. Nicaragua rubber is not at present met with in this country to any great extent, but there is no doubt that the purity and general qualities of this sample would gain for it a favourable reception, even if our supplies from present sources were more adequate to our demands. The chemical analysis of the ash of the *Castilloa* shows that there is no very marked difference in the mineral constituents of the juices of the Hevea and Castilloa under the present system of cultivation.

At a meeting of the German wood-pulp manufacturers a communication was read from Mr. Keller, describing how he first discovered wood-grinding for pulp. His first idea of taking wood as a substitute for rags was conceived by reading of the wasp's nest. Experiments with sawdust were, however, fruitless, and a remembrance from early days brought him to try wet grinding, using a common grinding stone for the purpose. He then obtained wood-pulp, and straining through a cloth, pressing between a book, and drying, the first sheet of wood paper was made within four hours. He finally built a small grinding apparatus, taking his wife alone into his confidence. He made several attempts to obtain a partner, but in vain. In 1845 he received a patent from the Saxon Government, and shortly afterwards was successful in leasing

a paper mill near Marienberg, but the owner became bankrupt, and although Keller afterwards bought the property, he was unable to carry his ideas into execution owing to straitened circumstances. Shortly afterwards, Voelter heard of his invention, and after some interviews became possessor of it for the sum of 700 thalers and a participation in profits. The year 1848-49 brought the Revolution, and 1850 a flood which completely stopped Keller's mill. In these circumstances he applied to the Saxon Government and received an advance of 2,000 thalers. An artificial "leech" of India rubber was one of the novelties invented by Keller in those hard times, but this was sold to an American for seventy-five dollars. Voelter, in the meantime, had not succeeded in deriving any profit or success, and finally the compact was dissolved, Keller being obliged later to give up his mill to the creditors. Voelter's further success is well known.

AN American contemporary says : Sorghum-sugar enthusiasts are properly alarmed at the perfection glucose has attained in the hands of skilful chemists, who have succeeded in getting 24 pounds of pure, dry, white, absolutely crystallized glucose, closely resembling loaf sugar, from each bushel of corn of 56 pounds, at a cost so low that by-products pay all the expenses of the manufacture, enabling the company to sell it for from 2 to 2½c. a pound in large quantities, and half-a-cent more for small. It looks much as if the sorghum men must make a fight to have this glucose sold under its own name, and not as cane sugar, which it is now used to adulterate and cheapen.

THE *Mexican Financier* has recently called attention to the value of the well-known American agave, a species of the aloe plant, found everywhere in Mexico, and numbering not less than thirty varieties. The fertile plains called "Los Llanos de Apam" have long been noted for the special excellence of the pulque, to whose production the plant is most exclusively devoted. Situated between Puebla and the city of Mexico, these plains are covered, as far as the eye can reach, with these flourishing plants, each of which produces pulque, the natural exudation of the plant, to the value of about six dollars, and then is supposed to have lost all its utility. In the district of Tequila no pulque is drawn from the plant, because its special virtues enable it to produce the brandy named after the district, and widely used throughout the country. This Tequila brandy is made by an old system dating back to the days of the Aztecs, and which consists of roasting the bulbs in a furnace dug in the ground. This gives a sweetish liquor, which, when cleared and subjected to the further processes of fermentation and distilling, yields the favorite brandy. But beyond this, no use is made of the plant. The same is the case in very district of the country where pulque and tequila are produced, and so notorious is the general ignorance or indifference to any further use of the plant, that its destruction is general when it has once passed its period for yielding either of these products. And yet there is very facility for utilizing the plant in at least four distinct industrial products, each of them very important and promising large returns. Next to pulque and tequila, the plant can be made to yield an excellent quality of molasses, by clarifying the sweety decoction of the bulb. Distilled, this becomes brandy ; undistilled, it yields molasses equal, if not superior, to any pressed from sugarcane. The peninsula of Yucatan has grown famous for its production of henequen or jute. The leaves of the maguey plant everywhere in Mexico, when pressed, yield a fibre in all respects equal to the best Yucatan jute. Various experiments, though on a small scale, prove this. Ropes are in use in a thousand districts of the interior, made from these leaves, and of unequalled strength and excellence. The peculiarities of soil and climate are of some importance in considering the uses of this fibre for cordage, but even where it is found somewhat inferior in this respect, which is rarely the case, the pressed leaves yield a pulp absolutely unequalled for making paper. The paper mills of Belem have repeatedly produced an excellent quality of paper made from this pulp, and is has not made its way into commerce, only because no one has as yet taken hold of this virgin industry, and produced the pulp in marketable quantities.

THE *Live Stock Journal* says : It is important in all branches of industry to consider the sources of income, and their availability at short periods. Sheep afford a *double income* annually,—lamb and wool,—and they are usually about equal in value. The power of assimilating food is one of the most important of animal functions. Sir J. B. Lawes, in his experiments to determine the percentage of food utilized, or stored up, by different animals, found that sheep stored up, in increased weight, 12 per cent of dry food consumed, whilst cattle only laid up in increased weight of 8 per cent.—that is, 8⅓ pounds of dry food increased the weight of sheep as much as 12½ pounds did the weight of cattle. So that, if these experiments are to be trusted, sheep must be considered as excellent utilizers of food—as producing, at least, as many pounds of mutton, besides the wool, from a given quantity of food as can be produced of beef ; and, as the best mutton brings as high a price as the best beef, it would appear, on this basis, that sheep would give the fleece an extra profit over cattle. On this view sheep, on suitable lands, must be considered among the most profitable of farm stock. It is true the dairy cow brings her profitable flow of milk to offset the fleece of the sheep ; but the good dairy cow does not lay on flesh while in milk, as does the sheep while growing the fleece.

THE value of the eggs annually consumed in the United States is stated to be $75,000,000. There are many ways of preserving them, when plenty and cheap, for the time of scarcity, but very few have proved to be entirely successful. A correspondent of the *American Dairymen* says that after trying several methods, he has found that eggs covered with melted paraffine kept the best of all, and those of them that were put down in weak brine, in which they sank to the bottom, kept better than others packed in dry salt or in plaster. He mentions also a German preparation of salt, saltpetre, and borax, which however is patented in America. He had some eggs put down in this for five months, and they were equal to fresh eggs, even when boiled for eating, a very delicate test, as eggs very soon exhibit any staleness when so cooked. An omelette made of eggs put down in this solution was very good, and so was one made of eggs a year old kept in paraffine, as was also a sponge-cake made of beaten eggs.

THE life of telegraph poles is estimated as follows : Cedar, 16 years ; chestnut, 13 ; juniper, 13 ; spruce, 7 years. Cedar, chestnut, and spruce are used in the Northern States, juniper and cypress in the Southern States, and red-wood in California. Poles cut in the summer will not last as long as those cut in the winter by five years. Soil and climate, of course, make a difference with the life of poles.

MR. C. BENSON, Assistant Superintendent of Government Farms in the Madras Presidency, having obtained permission to visit the works of some of the leading Agricultural Implement Makers, and the Experimental Farm at Rothamstead, has submitted the results of his investigations, in the course of which he makes the following suggestions :—"I would venture to point out the extreme desirability of doing everything within the power of Government, to introduce into India an improved plough suited to the conditions of the Indian cultivator, as regards his poverty and the strength of his cattle. As far as my experience goes, no thoroughly satisfactory plough has yet been made, and it is probable that in various parts of India, slight modifications may be required to meet the ideas of the ryot, but for the greater part, as now, one general form of plough would meet the demand. Again, that it is desirable to strain every nerve to create a demand for improved ploughs, no one who has studied Indian agriculture, and the effect which the improvement of it would have as a means of preventing famines, can doubt. The Indian farmers also cannot draw on the world for supplies of manure to replace withdrawals made by the crops raised as the English farmer does, but must rely on indigenous resources. The greatest store of these lies below the surface stratum of soil at present tilled, and to reach this, the ryot requires a better tillage implement than he now pos-

senses. I, therefore, venture to urge that samples of the light ploughs made by the chief makers should be obtained and sent out to the different provinces of India for a thorough trial, so that, when the results were reported, with suggestions for the modification, if necessary, of any of the ploughs which appear suitable, or with samples of what is required, together with information for the use of the manufacturer of the price at which similar ploughs can be made up in India, the question can be solved, whether a cheaper article (in every sense) can be obtained for the ryot in England or from native makers. It would also hereafter not be out of place, nor bad economy, for Government to dispose of a considerable number of ploughs of the pattern selected to the ryots in different parts of the country at reduced prices, themselves bearing the actual cost.

"A trial, such as I have ventured to sugggest, would be of the greatest value, both for solving the question referred to above, as well as for putting within the reach of the ryots a suitable and tolerably efficient plough. The cost would not be great, but the trials would have to be conducted most carefully and under as varied conditions as possible, and would require the assistance of an engineer and an agricultural expert in either case.

"Besides the urgent want of a good plough for general purposes, there is little scope for agricultural machinery in India, the native implements being either sufficient or capable of easy improvement. Exceptions may be mentioned in a low priced simple winnower, a seed drill with the power of controlling the seed supply and depth of sowing, not now possessed by the native drill, and an implement suited to the operation of breaking up black cotton soils to a great depth in order to eradicate the strong deep-rooted grasses with which they become overgrown."

In North India, the Government of the North-Western Provinces are carrying out the latter operation with a set of Fowler's double engine steam ploughing tackle.

In the Bellary dictrict, a large demand sprang up last year for strong heavy ploughs for this purpose, and a native merchant ordered out over 300 of different patterns from Sweden to meet it. The ploughs obtained, although they can do the work desired, are not the form of implement best suited to the object in view, and, acting on information I gave them, Messrs. Ransomes have put in hand a special implement, or rather a form of plough, for the purpose, which will weigh about 150 lb., have two long handles, one wheel, all parts wrought iron, steel *digging* breast, and share, trussed beam, and made to work about 12 inches deep, and to cost about £4. This they also intend to send out to Madras, with a request that it may be tried later on in the year. It is very desirable that this should be encouraged, as such an implement would be very valuable in the large tracts of country where the black cotton soil prevails, and the operation is necessary, for with the rough native implement now used, it is extremely costly and tedious.

It was purely accidental that the order went last year to Sweden, and if the English agricultural implement makers were kept fully informed of what was passing in the agricultural world in India, they would in all probability be able to compete with the Swedish manufacturers, where prices are generally more favorable. For this purpose, I would urge that all the leading firms should be regularly supplied with all reports, &c., on the agricultural operations conducted by Government in India, and especially with reports on the agricultural systems of different localities, such as that of Mr. Robertson's on Coimbatore (1876), and mine on Trichinopoly (1878-79), Cuddapah and North Arcot (1879), and Bellary (1880).

Besides a heavy plough for the use of the ryots themselves in the operations referred to above, a large steam implement for reclaiming large areas for use by Government, or large landholders, as has been done by the North-Western Provinces Government, would be most useful, and, after seeing "Darly's Steam Digger" at the Reading show, I went down to the neighbourhood of Chelmsford and saw one of them at work. This implement seems well suited to the work, but it travels over the ground it cultivates, a principle which has never hitherto succeeded, and is still undergoing improvement as a new machine. From the report of a public trial, it appears more economical than a steam ploughing tackle, whilst it is less cumbrous and less costly, although still the price (£1,000) charged for it is heavy for the machine as it stands. If, however, any Government in India is desirous of following the lead of that of the North-Western Provinces, I would suggest that the value and suitability of this machine should be considered before obtaining a set of steam plough tackle.

Messrs. Hornsby have been making a reaping machine for cutting indigo. It is a back delivery machine, cut 3' 3" wide, weighs 4½ cwts., and the price, packed and delivered in London, is £19. It is geared for use with bullocks and made extra strong for cutting indigo. This machine appears to have met with considerable success in the Bengal indigo districts, and its introduction at Madras might also be useful in some of the indigo districts, and would certainly be so at Saidapet for educational purposes. The same firm have been making also an automatic delivery reaper in the same style; its price is £24, unpacked.

No one who has visited Rothamstead, and seen and heard of the results of continuous corn-cropping there, can any longer be in doubt that our Indian soils have been greatly exhausted, or rather reduced in productiveness to a very low ebb; in fact, reduced to very much the same point as, if not lower than, that of the plots which have now for 30 or 40 years been growing wheat and barley at Rothamstead continuously without manure. On these plots, it is found that the average production for many years was reduced at an average rate of about one-fourth bushel per annum; but that, after the outturn had got down to about 12—13 bushels of wheat or rather more barley per acre per annum, further reduction does not go on nearly so fast. This fact explains why it is that Indian soils, with their very small produce, have not shown generally within recent years those signs of further exhaustion which have been expected by some.

The following figures show the results obtained from plots continuously unmanured :—

	Average Annual Outturn of Dressed Corn.			
	Fifteen Years, 1852—66.		Fifteen Years, 1867—81.	
	Bushels.	Weight.	Bushels.	Weight.
		lb.		lb.
Wheat—				
Plot 3	15¼	877	11⅛	644
,, 20	15¾	881	11½	644
Barley—				
Plot 0-I	21⅝	1111·5	14⅝	749
,, 6-I	24	1,251	14¼	772

These figures show that the average production of wheat in the second period was 27 per cent lower and of barley 36 per cent lower than in the first, taking the weights per acre.

The effect of season on such small crops as are now obtained, which it should be remembered are very like average Indian crops, is most marked. The figures for the last two years are shown below :—

	Dressed Corn Obtained.			
	Bushels.	Weight.	Bushels.	Weight.
	37th Season 1880.		38th Season 1881.	
		lb.		lb.
Wheat—				
Plot 3	11·5	654	13·75	787·5
,, 20	12·75	701	15·375	867
	29th Season 1880.		30th Season 1881.	
Barley—				
Plot 0-I	18·75	962	17·875	898
,, 6-I	21·5	1,094	15·625	791

may never become demonstrated to our actual physical senses. And the beautiful law known as the "conservation of energy," and of which Dr. Faraday said "it is the highest law of physical science which our faculties permit us to perceive," is another of these discoveries which explain and remove many difficulties from the path of the student. But in agricultural science, although even these laws of physics have aided greatly to make investigations more certain and more effective, yet we have not one broad and distinct law yet laid down as a basis upon which any satisfactory practice can be built up, or one which is not full of doubts and difficulties, or which is not at once fiercely combated by other investigators.

We had the mineral theory of Liebig which was popular 30 or 40 years ago; then came the nitrogen theory of Boussingault, Lawes, and others and the totally different one of Ville and some others, one displacing the other, but yet retaining some disciples and believers, who to-day are discussing and debating, and each to his own satisfaction proving the truth of his own theory. And the result is that the practical farmer is entirely without help, and is confused and misled by the multitude of opinions all differing from each other, and the uselessness of any one of them to afford him any aid in his labours in the field. In fact, it is questionable if there is one useful result that has been of any benefit to the farmer of all the investigations which have been made in the science of agriculture. The only approach to any useful service has been the valuable practical information furnished by experiments in the field conducted upon scientifically accurate principles, and by the methods of the farm rather than those of the laboratory.

The fact is, that however desirable and interesting they may be to the intelligent farmer, the results of scientific investigations are nothing more than pleasant readings and subjects for thought and mental culture, just as any other scientific matter might be; and the farmer is apt to regard them wholly in this light and therefore value them rather lightly. And it may be that this is the reason for the failure of the scientific schools of agriculture that have been instituted for the education of young farmers, as well as for the general want of respect for agricultural science among practical farmers as well as for the barrenness of results from the agricultural colleges and the experimental farms in and upon which there has been too much dependence upon strictly scientific methods of teaching and work. "A little knowledge is a dangerous thing." This is true, but not directly or positively because the knowledge itself tends that way. On the contrary, a little knowledge is good and useful and beneficial so far as it goes, if the possession of that little has not debased the mind and led it astray and unbalanced it. But this is too often the case when one has become possessed of a smattering of scientific knowledge, and that only partly learned, and has learned to believe that the little he knows enables him to deal justly with matters of which as yet he knows nothing. It is just as when the miner begins to work a vein of ore. He penetrates so far, and so far he knows. But if he is a green hand he is too apt to believe that all the ground he has blocked out, and all that between and beyond his narrow drifts and level, is rich ore like that he has been working through, and he figures up accordingly and believes he is possessed of a vast store of wealth. He therefore builds great and costly mills and spends all he has earned in machines to work up the ore which he believes is "in sight," as he may say, and within his reach, And when this is done the first stroke of his pick or the first blast shows him the barren rock where he expected rich ore, and the man's hopes and expectations are blighted and he is ruined. But the experienced miner escapes all this. The little knowledge he gains in the exploring of his mine is not dangerous to him, for he counts upon nothing further or beyond what he can take out, and actually gains, and he expends nothing from no settled belief upon any premises beyond those which he knows to be actually existing, and so escapes injury and loss. It is precisely so with the student of agricultural science. If he is not practical as well as scientific, and tests his science by actual practice as he goes along, he will very surely find himself all wrong, and will be but a blind leader of the blind.

A young man cannot learn to be a farmer at a scientific school any more than he can learn to be a blacksmith at a university. He may perhaps—and not then unless he is shrewd, level-headed, and cautious—prepare himself well to become a farmer by practical work afterwards, and acquire the ability to work more effectively because of superior mental discipline and general intelligence; but the time spent at an agricultural college or scientific agricultural school is too short for this, and the student departs from the institution with no desire to put his acquirements into practice in the field or the dairy; but unfortunately thinks he is better qualified to become a teacher himself, and so seeks a vacant chair and a professorship at some other school or college, or attempts to instruct farmers through some agricultural journal. And then it is discovered how dangerous a thing a little knowledge is.

Agriculture is eminently practical, and it can only be taught practically, or scientifically along with practice. An agricultural school or college without the best practical instruction or demonstration is as useless as a medical school without the operating room, a school of nurses without a hospital, or a school of chemistry without the laboratory. And the scientific instruction of the agricultural school should be illustrative of the practical work, and used for the purpose of explaining this. There are many farmers who desire to give their sons a good practical education as farmers, dairymen, or stockmen. But these young men are sent to farms, and not to schools, for this course of training. This is to be regretted, because the practice, the handiwork only is learned. It would be better if these young men could study at a well-appointed and a well-conducted scientific and practical school, managed on the same system as the schools of mechanics and technology are, and one where their education could be completed as far as it is carried. But, as yet, there are no such schools, although attempts have been made to found them; and no teachers who can take the plough and turn a model furrow as an illustration of the principles upon which ploughs are made and land is ploughed, as well as teach their pupils the mechanical part of the art. These, however, are what are required.—*New York Times.*

THE DEVELOPMENT OF THE MINERAL RESOURCES OF INDIA.

An interesting series of four lectures has just been delivered to large audiences at the Sassoon Mechanics' Institute, on the development of the mineral resources of India, by Mr. Alfred N. Pearson. The lecturer is an Associate of the Royal School of Mines, was lately resident engineer to one of the Gold Mining Companies in the Wynaad, and is at present acting Meteorological Reporter for Western India. The following is an outline of the four lectures:—

The lecturer said that at a period when one of the most gigantic mining experiments ever tried seemed to promise nothing but gigantic failure, and at a time when it was the policy of the Supreme Government to foster industrial effort, and to force the growth of manufactures, it seemed very opportune to take a look round and see what could be learnt about the mineral resources of India. There could be no doubt that, had intending investors in the Indian gold fields paid more attention to the known facts concerning the mineral wealth of the country, there would have been less rashness displayed in the adventure. And whilst it might be assumed that in the steps recently proposed for the supply of country-produced iron to State Railways, the Government of India was acting under competent advice: still it would be interesting in the light of that arrangement to notice how important in the preparation of metals were those minute practical details which were the result of long experience only. There was a general turning of attention towards the potential wealth of India, and an evident willingness to see what could be done towards its development.

The lecturer then alluded to the custom in former years of representing India by the figure of a pagoda tree, under which one could recline and pick up wealth with no greater labour than that of gently shaking the golden fruit from the richly-laden branches. Now-a-days, some people thought that either the figure had been misleading, or the tree had ceased to be so fruitful, for the pagodas no longer dropped off with a gentle shaking, and even when one stood to and shook vigorously, they generally fell but in scanty numbers. However this might be, there was no doubt that the figure grew up out of a solid ground of fact; and, indeed, it was well known that the correctness of India's traditional character was confirmed by historical evidence. The lecturer then pointed out how Sanskrit, Hebrew, and Greek writings, as also more recent ones, such as those of Marco Polo, bore witness to India's ancient mineral wealth. It was needless to remark, however, that wealth was a comparative thing. A man enjoying an income of a thousand a year, and living in a community of men who none of them earned more than two hundred, would be regarded by his fellows as a rich man; but if some of those recipients of two hundred a year were enabled by some stroke of fortune to raise their incomes to £10,000, they would begin to regard the man with his thousand as comparatively poor. India in early times occupied the position of the men with a thousand a year, while the rest of the nations, Egypt perhaps excepted, earned only their two hundred; but of late years, England with the marvellous growth of its iron industries, America through the discovery of its gold and silver deposits, South Africa with the diamond mines, and Australia with its gold, had thrown the wealth of India into comparative shade. Moreover, the supply by these countries in so large quantities of the metals and other useful mineral products, together with the great advances in navigation, had rendered it possible to offer in the bazaars of India those foreign productions at a cheaper rate than those indigenously produced.

He then proceeded to the inquiry as to what were the actual mineral resources of India. He showed a table which he had prepared, giving a list of 82 useful minerals, and dividing the whole of India into 103 different areas. An easy reference to this table would show in which of those 103 areas any particular one out of the 82 useful minerals occurred, and whether it was present in only mere traces, or in payable quantities, or whether further examination was needed. The information for the preparation of the table had been obtained almost exclusively from the publications of the Indian Geological Survey; and mainly from the third volume of the "Geology of India," published by that department. The useful minerals of India were for the sake of convenience divided by the lecturer into fuels, metals, precious stones, building stones, clays, cements, chemical requirements, manures, and miscellaneous substances. It was impossible in the space of four lectures to undertake a detailed inquiry into the deposits in India of all those minerals: out of 82 of the economic minerals they could give a general glance at only 28. Under the heading of "Fuels," the coal fields of India were touched upon, and it was stated that India contained the thickest known coal seams of the world, some being 100, 120 and 160 feet thick. On the Ranigunge coal field, which had a probable area of 1,000 square miles, there were in 1872 no less than 44 mines at work. In 1879 this field yielded 523,000 tons of coal, and gave employment to 389,000 men, 195,000 women, and 27,000 children. The expense of carriage of coal over land was very considerable and prevented the Indian coal fields from meeting much more than the local demand. Coal which in 1880 sold at 2½ to 3 rupees at the pit's mouth on the Raniganj coal field, cost 7 to 8 rupees in Calcutta and no less than Rs. 30 in Lahore. Mr. Ball, in his little book on the "Diamonds, Coal and Gold of India," stated that the annual consumption of coal in India was upwards of one

and-a-half million tons, and that in round figures two-thirds of this amount was raised in the country. As a sign of progress in the development of Indian industries this statement was not unsatisfactory; but it was completely dwarfed when one turned to the statistics of the English coal fields, where in 1872 not one and-a-half million, but 123½ millions of tons of coal were raised, 16 millions of which were exported, and the rest consumed in the country. Other fuels, such as wood, peat, lignite, and petroleum were dealt with; and before leaving the subject of fuels, the importance of the sun's heat as a fuel was pointed out. However unequally wood and coal were distributed over India, there was no doubt that sunshine was given impartially enough. Some efforts to use it in a concentrated form had been made in the drying of tea but with only partial success. For most chemical processes and even for brick-burning, the lecturer believed a determined effort to apply it would result in success.

Amongst the group of metals, the lecturer touched upon iron, silver and gold. Gold, it would be ascertained by a reference to the aforementioned table, occurred at 41 places out of the 103, and out of these 41 places there were no less than 11, where it has occurred in sufficient quantity to make its mining profitable. There was abundant evidence to show that gold was formerly obtained from these places in large quantities; but there was no evidence, so far as the lecturer was aware, which showed that the miners who obtained these large quantities grew wealthy by their industry. The south of India was, and appeared always to have been, the most important gold region in the country. The river beds all about the region of Malabar were known to contain gold: in many places the inhabitants had traditions of gold having been washed there; some of the rivers and villages were named after the precious metal. These rivers took their rise in the Wynaad, the Nilgiris and the neighbouring hills. The occurrence of gold so generally in these rivers did not, however, imply that rich deposits of gold would be found in the mountains whence the rivers sprang; for it should be remembered that the water of the rivers effected a process of concentration, carrying away the lighter praticles of mud and sand, and allowing the heavier, amongst which was the gold, to remain behind in the river beds. As a matter of fact it would be found on a sufficient examination that the rivers had got nearly all the gold, and that there was very little of it left in the rocks *in situ*. Most of the reefs in the Wynaad were but the ruins of what they once had been. Ages ago, at a period so long back that it must be reckoned not by historic, but by geological time, there could be no doubt that the reefs of the Wynaad were extensive enough, and that it was then a gold region of very considerable magnitude. But now there are to be seen, generally speaking, only fragments of this former greatness. The mills and the reefs with them have been washed away by the incessant action of the weather. After a further description of the gold regions, the lecturer went on to say that, as to whether the 44 companies and the four millions of money engaged in the gold adventure in the south of India would or would not produce profitable results, he has no hesitation in saying that as a whole they would not. They could not, and no reasonable man would expect a mania to result in anything but disaster. Taken individually, some few of the companies that had gone cautiously to work might succeed, especially if they had been fortunate enough to find "pay shoots" of fair size and after but a short search. The easily and quickly found "pay shoots," however, namely, those which came up to the surface, had been nearly all worked out years ago by the natives; and it required no illustration to show that the underground search for these might involve an expenditure of considerable time and money, and after all result in nothing but failure. Amongst the precious stones, the localities of occurrence of diamonds, corundum, agates, &c., rubies, sapphire, and lapis lazuli, were mentioned, and some details given as to the nature of the deposits. Amongst the building stones, were specially noticed the granites, slate, and marble. Amongst the clays, pottery clays, more especially Radlin deposit were mentioned; and the necessity for attention to a deposit of fire-clay pointed out and emphasized. The mineral resources of India could not be developed without furnaces and furnaces could not be built without fire-bricks; yet nearly all the fire-bricks used in India were imported. Amongst cements, the materials for the manufacture of Portland cement and of plaster-of-paris were mentioned, and their occurrence in India pointed out. Amongst the chemical requirements, alum, sodium, carbonates, borax and iron pyrites were noticed. Under the heading of alum the manufacture of Kutch alum was noticed; the process of manufacture was stated to be unique. The lecturer said he had ascertained the deposit of alum earth in that state to be probably extensive enough for the supply of all India with alum for some hundreds of years. The mineral manures were of great importance, and would become more and more so in this country every year.

Having briefly indicated the occurrence of the more important minerals in India, and pointed out where complete information about them could be obtained, attention was then directed to the work of their actual development. Having fixed upon the development of any particular mineral deposit, the first step to be taken was to find out in a general way what might be the extent and average quality of the deposit, and to make sure of a certain definite value of the same before sinking a large amount of capital in the undertaki[illegible] This process was known in mining language by the term "pr[illegible]" a word which simply meant a looking before hand. [illegible] looking beforehand was one of the most important branches of mining engineering, and required no little exercise of knowledge and natural skill to accomplish it successfully. Its importance would be apparent to every one. It was a very old observation that a man going to build a house, "first sitteth down and counteth the cost." Had this matter been more widely understood by intending investors in Indian gold mines, there would have been less capital invested in those concerns. The lecturer described and illustrated in considerable detail the nature of reefs and of vein deposits generally; and showed the methods of the underground prospection and actual working of these, illustrating his descriptions throughout by diagrams and drawings on the blackboard. He described the methods of supporting mining excavations by timbering and masonry; and pointed out the special difficulties in this part of mining work in India owing to the softening of the ground by the monsoon rains. He concluded by expressing a hope that the lectures, necessarily of a somewhat general and outline character, might stimulate some of the natives of the country to look upon mining work as affording a useful and suitable career for a man throughout life. Such work had frequently been regarded as of an inferior kind. This idea had doubtless originated from the characters of several men who had entered into it. Being necessarily a work considerably of chance it had attracted men of a gambling turn of mind, who had done not a little to injure the reputation of the industry. But he thought that when all was considered which had been brought forward in the lectures, it would be perceived that mining work was properly of a most honourable character, presenting as it did problems which called forth for their solution the best natural abilities and acquired attainments.

At the end of the fourth lecture, the chairman, Mr. Forde, the Consulting Engineer to the Municipality and President of the Sassoon Mechanics Institute, said that he was sorry to have to announce that this was the last of Mr. Pearson's very interesting and able lectures; and he was sure they would accord a hearty vote of thanks to him for the trouble he had taken in their preparation and delivery. Mr. Pearson, in reply, stated that it had given him great pleasure to be associated with anything useful, but that he had been greatly encouraged in his by-no-means easy task by the constant attention with which the lectures had been listened to.—*Times of India.*

THE AGRICULTURAL EXHIBITION.

I.

THE agricultural exhibition which has recently been held on the island has deservedly attracted a large amount of attention, and, it is to be hoped, will be productive of as good results as similar gatherings have been found to lead to in America and England. Nine years ago a similar exhibition was held, as some of our readers may remember, at Saidapet, and it was originally intended that there should be an annual one. Various reasons led to the Government postponing the idea, the famine being one of the chief; and it was not until last year that Mr. Robertson was able to persuade Government that the time had come for taking a new departure in this respect. It has now, we believe, been decided that a general central exhibition shall be held in Madras quinquennially, or septennially, and that, in the intervening years, district shows of a similar nature, but on a smaller scale, shall be held annually in various selected localities. This, we think, is likely to lead to better results than, as seems to be the wish of some, would arise from holding annual exhibitions in Madras itself. The only fear is that the experience gained in the present case may be lost, and various errors and defects, which we shall notice hereafter, may occur, and in a great measure lessen the value which should be attendant on a well-devised and managed exhibition. Such gatherings as we have recently witnessed, to be of full value, should be arranged so that not the slightest hitch should occur; and there should be no difficulty in making out what the exhibits are, and whence they came; for their greatest value lies in keeping the public informed of where they can obtain what is brought before them at the exhibition, and the probable price of such articles.

In the section of the show directed to live-stock, we have not much to complain of, but we must remark that we fail to see the utility, apart from its adding to the attractiveness of the show to visitors, of any money being spent by Government in trying to get together any number of horses. Horses, as is well-known, play no part in the agriculture of Southern India; they are neither used in farming operations, nor are they bred for sale. It seems to follow, therefore, that the money offered as prizes for them at the recent exhibition might, on another occasion, be much better spent in rendering other portions of the exhibition more complete. Amongst the cattle we have only one thing to complain of, and that was the difficulty in distinguishing which animals were competing for particular prizes. Practically, the only cattle shown were Nellore, for the other stock were but a poor show, and it is most regrettable that no Mysore cattle were brought forward. We have in this Presidency in reality only two good breeds of cattle, the Nellores and the Mysores, and each type fills a different place; the former are a large, heavy-framed, powerful breed, producing good draught animals for slow work which requires great strength; the latter are light, strongly built, and active animals, very suitable for the ordinary operations of farming and road-work. The Nellores have the additional advantage of being fair milkers, and therefore more generally valuable to the native; but they are too large and heavy for use in crossing on the small, degenerate, breeds of the Southern districts, with a view to their improvement. The Nellores at the exhibition made really a splendid show, and the two magnificent old bulls, brought down by their owners from near Ongole simply for show, were as fine specimens of the breed as any one could have wished for. As might be expected, however, [illegible] showed the defects of the breed, a heavy, languid appearance,

want of girth in the chest, although in depth of carcase they were not specially deficient. Amongst the younger bulls, both yearlings and those under three years old, the tendency which the breed has to run to leg was much more marked, and showed that in one respect at least the breed is capable of great improvement, and that is in early development. In three years it should be possible, where it is feasible to raise such stock at all, to turn them out nearly fully developed; but it would appear that the Nellores do not reach their full development until five or six years old, or later. Amongst the cows of this breed there were shown some remarkably fine animals, but we could not understand some of the awards; some animals were apparently passed over without cause, and inferior ones placed above them; in particular, we could not agree with the judges in the award to the old cows, for the fourth prize cow appeared to us as fine as the winner of the first prize, and much superior to those placed second and third, whilst another particularly fine cow was left out entirely. As long as the judging is placed in the hands of amateurs, who have had few chances of acquiring the special skill necessary to adjudicate on the different points of cattle, the results of their awards must necessarily be open to criticism; but we fail to see why it should be impossible to find qualified judges for the work. Surely a district which can produce such cattle as it was our pleasure to see assembled last week, can also furnish competent judges. To the heifers of this breed the same remarks, as we have already made with reference to the young bulls, equally apply; but there was not the same uniformity, in colour at least, displayed, indicating perhaps that some not pure bred animals had got in.

Of working cattle, whether for heavy or coach work, the show was very poor, and this is in a measure surprising, as it would appear likely to have been a profitable undertaking for the breeders to bring down animals of this sort, for which we imagine there is a ready demand. As it was, the only pair (and a fine pair) of heavy draught cattle came from Arcot, where they could not have been bred, and even these would not have compared favourably by the side of such magnificent draught cattle as we have seen in the Ceded Districts. At present, heavy draught cattle are only bred in Nellore, and the chief market is in the districts named, the cattle being taken over annually by the dealers and dispersed by them over the country. The light draught cattle were a better show in point of numbers, but not in quality, and the show was really poor in quantity, considering how much larger a stock of this type of animal there is. We saw no representatives of the draught bullocks of Coimbatore and Salem, nor any of the true Amrhut Mahal type in its best form, those shown having something of the latter type, but appearing under-bred. This latter type of animal is specially adapted for improving both the form and size of the diminutive Carnatic cattle, as being intermediate between the latter and the heavy-built Nellores. One very interesting exhibit we did notice in this section of five young bulls of the Aden breed, imported by Government last year, with the object of furnishing sires of a good milking strain for use in the districts, the experience gained at the Saidapet farm with a bull and cow imported in 1874 having conclusively proved the value of the breed in this respect. Besides their good milking qualities, the breed is remarkable for its docility, and at the same time the animals are of fair size and form, and intended to improve the ordinary ryots' stock considerably. It is only to be regretted that 500 instead of five such young bulls could not be supplied for use in a selected locality; but we must remark that until all other stock-getting animals are removed, or their powers destroyed, no really good results can be expected to follow from the use of five or of five-hundred sires of good breed. The remainder of the cattle were not worthy of much attention, and, though in some cases evidencing great spirit of enterprise on the part of their owners, did not show favorably beside the great gathering of Nellores. One cow only do we feel specially called on to refer to, and that was a brute shown by a gentleman in Madras, to which the judges awarded a special prize—why, we cannot understand. In a milch cow docility is of primary importance, and a more dangerous and vicious beast than this one we have seldom seen: in form the cow had several good points, but her temper was enough to cancel them all, and the only thing she appeared fit for was the butcher.

The show of sheep was poor, and here the chief exhibitors were Europeans. The cattle were chiefly brought down by native breeders for the show simply, as they refused to sell many of their animals. Of course persuasion may have been freely used by the district officers to induce the cattle-breeders to come down with their stock, but nevertheless it is disappointing that, in a province containing some four million sheep of several distinct and well marked breeds, so poor a display should be made. There is, we believe, no reason why India should not equal Queensland in wool growing; we have good stock to begin on, which, if small, is hardy and covered with wool, which only requires judicious crossing and selection to be improved greatly and rapidly. The small exhibit (for show only) from the Saidapet farm was interesting as showing the results of selection in breeding, but it only brings home to our mind the pottering manner in which this great subject has been taken up in India. We hope for better things ere long, but Government ought to be in a position to supply every flock-master in the country, who can be induced to take them, to the exclusion of rams of his own breeding, with sires for breeding of a good, thoroughly acclimatised hardy, wool-bearing type of sheep. The show of goats was small, although there were some interesting exhibits, but that of poultry was full, and was interesting as showing that the natives are, to a certain degree, taking to keeping fowls of good breeds, a good number of the prize-winners being natives. On the whole, the exhibition of live-stock was successful, but it will be well, on another occasion, to endeavour to get together more working cattle, sheep, and particularly representatives of the Mysore breed. Our remarks on the arrangements of the Exhibition we shall reserve for another occasion, when we have had an opportunity of referring to the dead-stock exhibits.—*Madras Mail.*

II

TURNING now to the dead-stock exhibits, and first to the implements, machines, and tools, we must remark that, as a whole, the display was not gratifying. Though large prizes were offered for fibre-cleaning, oil-pressing, and paddy-husking machines, none were awarded, and it is much to be regretted that these prizes did not induce any manufacturers to come forward. Machines for the two first purposes are very much required, and though a Boomer oil-press was exhibited by itself, it is of little use, as the oil-seeds require to be crushed or bruised before pressure. Considering the extremely inefficient extraction made by the native oil-mills, and the large proportion of oil left in the refuse cakes after pressing, it is surprising that attention has not been more strongly drawn to the opening that exists for the introduction of complete and efficient oil-mills and presses into India. In the interests of the country agriculturally, it would be well worth while for the State to offer considerable inducements to any one who will introduce and work such presses as will prevent the seeds from being exported as now; for if the most valuable portion, the oil only, is sent to Europe, the country, that *is*, the *soil*, will lose little by the growth of oil-seed crops; but whilst the seeds still continue to be sent home, a continual and heavy drain is made thereon, while there is no corresponding import of manurial substances to balance. In fibre mills, again, there is a great want, and though the large prizes offered by the Government of India for the production of a machine capable of cleaning the rhea fibre have hitherto been without satisfactory results, there is also a great want of a machine capable of dealing with such plants as the aloe, the common plantain, and the manilla hemp, all of which contain strong useful fibres, but which cannot be extracted economically by hand. The hand-mortar for cleaning paddy, to which a prize was awarded, was only an ordinary native mortar, but of rather superior finish. It was, we believe, exhibited without its pestle! The only cotton-gin shown received a prize, and was one of the well-known pattern of Burgess and Key's emery's saw-gins, which have so long occupied a foremost position in gins of that type. Some native roller-gins were exhibited, but none possessing any better character than those in general use. The three patterns of Messrs. Thomson and Mylne's Beheea sugar mills, exhibited by Messrs. Oakes and Co., deservedly attracted attention both for their hardiness and efficiency, of which any one could judge, for they were shown outside the yard at work. This mill has been a great success in Northern India, and the first brought to this Presidency about two and-a-half years ago, after being tried at Saidapet, was forwarded for more complete trial to Bellary, and there compared well with the local mills, although far from being so superior to them as it is claimed to be over the indigenous mill of Bengal and the N.-W. Provinces. Since then, we learn that another of these mills has been sent to Bellary, quite recently, this time a three-roller mill (the first having only two rollers), and this has been much more successful. A mill of this last pattern was at work in the showyard, as well as a two-roller mill. Deservedly those mills obtained prizes, for they are portable and easily set up, and more efficient than the native wooden mill; whilst their price is nearly the same, and the materials of which they are made much more durable. When the wooden frame-works are made up locally, and the iron works only purchased from the manufacturer, the price of these mills should be reduced to a point considerably below that of the native mills. Messrs. Oakes, who exhibited these sugar mills, also obtained a prize for a winnowing machine made for them in England; but we think the machine is much too heavy and costly to be likely to meet with general favour in this part of India.

The most interesting part of the exhibition in this section was the comparatively large show of ploughs. For this Sweden, America and England all contributed, besides local manufacturers in Messrs. Massey and Co., and the Sangal Works at Saidapet. The judges apparently were unable to follow the classification of prizes offered by the Committee, and awarded prizes for ploughs, not according to the materials of construction, but according to the purposes for which the various ploughs were adapted. In this we think they were right, for the efficiency of ploughs can be more fairly compared in this way, it being manifestly impossible in any way to contrast the value of a "wood-plough with iron working parts," intended for breaking up black cotton soil to a depth of 12in., by means of four or five pair of large Nellore cattle, and one of similar materials designed to replace the crooked stick of the ordinary ryot, and to be used with his diminutive stock. Three classes were formed: one for heavy ploughs suitable for deep work, now performed by the ryot of the Ceded Districts, when reclaiming foul land, with his *pedda madaga* (one of which we saw in the exhibition); another for strong ploughs capable of doing all the ordinary operations of cultivation; and a third for light ploughs of low cost, which, though fairly efficient for general purposes, were specially designed to be made at a price within the means of the great bulk of our ryots. In the first division the show was good, but almost the sole contributor was Mr. Sabapathy Moodelliar of Bellary, who, besides three ploughs which the judges considered worthy of consideration, exhibited two English multiple-furrow ploughs, which he is using in Bellary. Besides the above-named gentleman, the Sangal Works exhibited a plough made on the lines of one imported by the Agricultural Department some years since from Sweden. The latter obtained the second prize, the first going to one of slightly different construction imported from Sweden, to the exclusion of either of the very useful looking ploughs made by Messrs. Collins, United States. In the second division, or ploughs of medium size suitable for general purposes, the competition lay between ______ exhibited by the well-known firm of Ransomes, Head and Jefferies, of Ipswich, and a plough made by the Onerums Bank, Sweden, of which a large number have recently been imported by the Agricultural Department for distri-

bution and sale throughout the presidency, and are made up by Messrs. Massey and Co., locally, something on the lines of the Swedish plough, but with considerable alterations. The first prize went to one of Ransomes' ploughs bearing their mark K.W.S., a very useful, light, and strongly built plough, costing Rs. 16-8, with steel-bearing parts and a wheel. The second prize was awarded to Messrs. Massey's plough, which, though built on good lines, had a considerable objection in that castings were made use of in it; its price with castings was Rs. 15, but made in wrought iron Rs. 18; and when made in the latter material, it should be a most valuable implement. The Swedish plough favored by the Agricultural Department was excluded apparently because of its weight, but at the price at which it can be delivered in Madras, Rs. 18, it is a wonderfully cheap, useful, and strong plough. In this case, as in that of other implements, we must remark that we cannot regard the awards as at all final, for, with ploughs especially, it is impossible to fairly adjudge their qualities without trial in the field, and with a dynamometer, besides having regard to their construction, the materials used, and the cost. On another occasion we trust that all the ploughs at least will be put through and through practical trial before the prizes are awarded; the exhibition will then be of much greater educational, or rather instructive, value to the visitors; and seeing the necessity that exists for Government to find out whence the best and cheapest (not lowest priced) ploughs can be obtained, we hope that the Exhibition Committee will recommend that all the exhibits considered worthy by the judges may be put through an exhaustive series of practical trials under various conditions in different localities. We have no quarrel to make with the award given, but we think the judges will admit that these awards were made on insufficient data; that a few hundreds of rupees spent in the way we mention would be productive of much good, we feel assured. Let it be advertised that the practical plough trials will be held in Bellary, at Saidapet, and in Tanjore, for instance, in July or August next, and let arrangements be made for the full trial of all such ploughs as are brought forward, and we shall then be well able to repose confidence in the verdict. In the third division of ploughs, that is, those of very light construction and low price, the judges divided the prizes between a small wood and steel plough made by Ransomes and an iron plough made by Massey and Co., both costing Rs. 10. In the latter the body, share and mould-board were all castings, and the two last portions being cast in one piece would have to be replaced together, though in practice five or six shares are worn out to one mould-board; this difficulty the manufacturer has, we believe, got over at a slightly increased cost; but the use of castings at all in implements to be placed in the hands of ignorant ryots we look upon as inadvisable, as an unfortunate accident might lead to the plough being thrown aside, and the whole tribe of which it is a type brought into disrepute.

We have entered so fully into the question of ploughs, that we have little space left for remarks on the other exhibits; but we regard the question of providing a good, cheap, and efficient plough of so great importance, and that of all other field implements at present of such secondary interest, that we believe ourselves justified in doing so. No suitable cultivator or grubber was shown for competition, although a second prize was awarded to one of Messrs. Coleman and Morton's make; but we observed one amongst an interesting collection of exhibits sent by the Saidapet Farm of very simple construction. In this place we must remark that we regard the rule preventing Government institutions from competing for prizes as a mistake. They should be allowed to compete, as they can often show the best and most suitable exhibits; and as these exhibitions are as valuable for instruction as for anything, the best exhibits should obtain the prize. It would be easy to arrange matters so that no money should be paid to Government institutions. Just as in the grubbers, so in the harrows; the one most suitable to the wants of the country was exhibited by the Saidapet Farm, but no attention was drawn to it by its being awarded a prize. The iron harrows by Howard of Bedford, shown by Sabapathy Moodelliar, for which a first prize was given, appeared to us much too heavy for general purposes.

Of the other articles shown, there is not much to be said. Both Messrs. Oakes and Messrs. Massey showed interesting collections of useful tools, and the former a collection of useful dairy utensils; whilst the latter were deservedly awarded a special prize for one of their well-known coffee-pulpers. Nothing new was brought out in the way of water-lifts, but the wind-mill working in the grounds attracted considerable attention, and we frequently heard the oft-repeated remark that wind-mills had not been sufficiently tried in India. Hitherto all the trials that have been made have been unsuccessful, and we do not hope for much from them in the future. In this department of the exhibition, as in all others, the same want of knowledge of what was being shown was patent to all, and we think that on another occasion some attempt at a catalogue should be made, at least of those articles competing for prizes. We hope to be able to refer to the raw products and manufactures exhibited at an early date, when we shall have something to say also on the general arrangements of the exhibition.—*Madras Mail.*

III.

WE have now come to the most difficult portion of our task, for it was in the portion of the Show devoted to raw produce that the arrangements were most defective, and where it was most difficult to discover what was what. The confusion which existed was, we believe, for the most part due to the hurry with which everything was laid out for exhibition, and also, in a great measure, to the exhibits being *forwarded* to the Secretary often without lists, and generally with no one in charge to see that the exhibits were laid out in a suitable manner. Consequently the whole work of laying out and arranging them as far as possible practically devolved on the Steward in special charge, on whose shoulders also fell, in addition, the same duty as regards the exhibits of manufactures. It was a simple impossibility for any one person to get into anything like proper order such a number of exhibits delivered in the state mentioned. About 3,000 exhibits were, we believe, sent in, and often a single exhibit consisted of many different articles, so that at least 5,000 or more articles had to be dealt with in the short time allotted,—three days only! It is surprising that so much order was actually attained, and that greater confusion was not visible to the casual visitor; but we hope that on another occasion the Committee of Management will anticipate the difficulty, and provide adequate means for laying out and displaying the exhibits in such a manner that the public may derive the fullest benefit from the Show. As it is probable that some years may elapse before another such exhibition is held in our city, we trust that the opinions of those Stewards of sections who did actually discharge the active duties of their office, will be asked for and recorded for the guidance of future committees, which must, from the shifting nature of our population, on a future occasion, consist almost entirely of new men, who will be altogether ignorant of the difficulties met with on the present occasion; and we also trust that when another exhibition is held the Stewards generally will have learnt better how to discharge the responsibilities which they have undertaken. The Stewards in each section of an exhibition should be practically a working Sub-Committee, and see that everything is arranged to the best advantage for display and instruction to the public, and should have such a knowledge of what is exhibited as to be able to direct the work of the judges, so as to save the labour and time. They will only be able to do this by insisting that all exhibits should be delivered in a proper state for exhibition at least a week or ten days before the Show is opened to the public, and so marked that no confusion can possibly arise, or the exhibits be placed in sections where they are altogether out of place. In a great measure the Stewards must depend on the exhibitors for facilitating the accomplishment of these ends, and with every exhibition the exhibitors will learn better how to prepare and send up their exhibits. In an initial undertaking like that recently held, of course a great deal must be in a rudimentary stage, and, considering all things, we must allow that a great deal of success was attained.

In the judging, too, we saw much still to be desired; the selection of competent judges ought to receive more attention, and the work should be more sub-divided; the judging should be done before the public are admitted; we can see no reason why the names of the exhibitors should not be attached to all the articles: and we regard it as essential that the cost of manufactured articles, as well as that of partially prepared produce, such as fibres, should in every case be stated and considered by the judges. In the selection of the judges, we think it must be evident to all that specialists should be selected; a man, who is a good judge of grains and fodders, is not necessarily a good one of fibres. In another matter also the Committee might improve matters, and that is in the simplification of the prize lists. Unless the exhibition is to be of a more permanent character in future, the offer of separate prizes for a long list of varieties of grains and pulses seems to us inadvisable, and the offer might will be confined to collections of the common grains with a few prizes for special new products, which it is desirable to encourage; paddy, however, should always be kept separate from the unirrigated grains. We should, nevertheless, look upon the establishment of a more permanent exhibition with favour. In a Show like the recent one, it was almost impossible for any one, with the amount of leisure usually at the disposal of most people in this country, to form a fair idea of the exhibits of any particular description of produce, it would be much more beneficial to the country if the exhibits of produce could be kept on show for several weeks, and thus afford ample opportunities to those interested to study them at their leisure. In the exhibits of grains and pulses, the visitor was brought face to face with the fact that the natives recognise a tremendous number of varieties of paddy; one collection from Malabar consisted of 116 samples, and to render the subject more confusing, the names of the different sorts vary in different localities, so that it may almost be said that the names of varieties of paddy are legion. The Committee attempted to classify all the varieties of paddy under the heads Kar and Samba—divisions well known in some parts, but altogether unknown in others of the Presidency. The show of paddy, as a whole, was disappointing; partly from the confusion, partly from the want of names, and a good deal from defective arrangements. Prizes were offered for samples of the Carolina and Madagascar varieties, but although we noticed that the judges had awarded prizes for them, we were unable to find them. The collections of various descriptions of unirrigated cereals were particularly fine and deserved great attention, but there also the want of adequate arrangements prevented the visitor from finding out whence the prize samples had come, and we believe that it was not until the close of the exhibition that the names of the owners were all found. It is doubtless convenient to give each exhibit a number, but a label bearing the mark "Exhibit No. 1,000, Div. (a), Class 1, Section B," does not tell much to those who come to see and learn! In the pulses, the same excellence of samples was visible, and we really can scarcely understand how the judges were able to discharge their work. On another occasion, it will be better that, at least with some grains, the sample should be accompanied by a sheaf of corn in the straw. The oilseeds also came out strongly, but nothing new was exhibited on a large scale, Tinnevelly alone coming forward, with a good collection of miscellaneous oilseeds, but in that case the quantity of each sort sent was very small. The exhibits of cotton were good, but it was not possible to see them to advantage, and before another

These figures show how carefully deduction must be made from the results of experiments, as a more propitious season than usual may lead to results which appear contradictory, and also how long experiments, of the description of those above referred to, must be continued before absolute results can be at all arrived at by averaging the returns of a number of years together. They should, however, be very valuable in convincing any one who is still sceptical of the fact, that Indian soils are in a very exhausted condition, for the latter are almost continuously cropped with corn of some description. A good deal might be done on Government Experimental Farms in India, in collecting data of a similar nature to those given above, and a commencement has been made already in that direction at Saidapet.

Another very remarkable set of results, of great interest to those connected with Indian agriculture, are those obtained in the growth of wheat alternated with fallow and wheat grown continuously on the same land in adjoining plots. They are given below :—

	Total Corn, lb.				Straw, lb.			
	After fallow.		Grown continuously.		After fallow.		Grown continuously.	
	Produce.	Half-produce.	Produce.	+ or — half-produce after fallow.	Produce.	Half-produce.	Produce.	+ or — half-produce after fallow.
Five years 1856—60 ..	1,598	799	1,012	+213	2,514	1,257	1,688	+431
Do. 1861—65 ..	1,608	804	953	+149	2,433	1,216	1,390	+174
Do. 1866—70 ..	936	468	834	+366	1,394	697	1,122	+425
Do. 1871—75 ..	786	393	656	+263	1,430	710	1,031	+312
Do. 1876—80 ..	754	377	567	+190	1,149	575	877	+302
Twenty-five years 1856—80	1,186	508	804	+236	1,786	893	1,221	+328
1881	748	374	863	+489	897	449	1,146	+697

The figures showed that over a period of 25 years half the biennial produce (*i.e.*, the average annual produce) of the land alternately fallowed and cropped has been 236 lbs. or 3¾ bushels of corn, and 328 lbs. of straw less than that obtained from the adjoining land continuously cropped with wheat. The figures for the crops of 1881 are also remarkable, and the whole series show the exhausting effect of continuous corn-cropping without manure, and still more so of alternate fallows; they also show how great is the effect of season on the outturn. The main results can be explained by the fact that the drainage through fallowed land carries off more nitrogen from the soil than that from cropped land. They show that though a *bare* fallow may be advantageous by allowing, through a temporary cessation of cropping, the soil to accumulate larger immediately available supplies of nitrogen (for other purposes) if the practice be continued, it is really more exhausting than continuous corn-cropping. These results ought to be remembered in India, where fallowing is generally looked upon as a most valuable preventive of exhaustion ; but there the danger is not so great as the loss from drainage would never be so much, as the native cultivator never bare fallows his land in the manner done in England ; he allows it rest from cropping, but does nothing at the same time to prevent the growth of weeds over the surface, or to open up the soil, so that it may be thoroughly aërated. The weeds in their growth prevent a considerable amount of loss by drainage.

It would be most beneficial if experiments similar to the above were carefully conducted on all Indian Experimental Farms.

The rain and drain gauges used, and the system of observing the results obtained, are also well worthy of adoption on Indian Experimental Farms, as very valuable data could be collected by that means. They are fully described in the Journal of the R. A. S. C., Part I of 1881.

The above are the chief results, &c., which I noticed at Rothamstead that are of most interest in India ; but the care with which the soils are sampled frequently for analysis, the grasses from the continuously manured grass-land are collected, sorted, and the effects of the different manures on the herbage tabulated, and the work always going on the laboratory in analysing the soils and samples of the corps grown, are most striking.

With reference to one problem which has received a great amount of attention, and which is still a point of controversy amongst agricultural chemists, *viz.*, the sources of the supply of nitrogen to plants, Dr. Gilbert requested co-operation from the department to which I belong, and especially asked that he might be furnished from Saidapet with the following information :—Statistics of produce of leguminosæ on sandy soils With information, if possible, of the average percentage of nitrogen in the dry matter : how frequently the crop can be grown, and whether it leaves the land in an exhausted or improved condition for other crops (cereals, &c.); stating how the crop is dealt with, removed, ploughed in, or fed off, and he added that "it would be very desirable if careful samples of the soil could be taken to every 6 inches to 4 or 5 such depths, and the nitrogen determined in the land before sowing the leguminous crop, and also after its growth and removal ; it being essential to have the samples from a fixed area and depth. Four, five or six samples should be taken from each plot or field at each depth. Of the surface samples half of each should be kept separate, and the other halves mixed ; of the subsoils a mixture may be made of all of the samples from the same depth in each case ; the reason for retaining half of the surface samples unmixed being for reference in case a suspicion that any one contained the droppings of some animal arose. The weight of the soil samples should be taken in the field ; afterwards they should be sifted successively through sieves of 1 inch, ½ inch and ¼ inch mesh, and the weights determined in each case and calculated back to the original ; what last passes through call 'mould.' Then determine the dry matter in the mould at 100° C after powdering finely and calculate back to the original 'weight.' Although the above data have been asked for with special reference to the Saidapet farm, if similar figures could be obtained from other parts of India and on different soils, they would be most valuable in assisting in the solution of the problem I have already referred to.

On his farm at Sawbridgeworth, Mr. Prout has been growing corn continuously over nearly its whole area for nearly 20 years without intermission, and the crops he now grows are very heavy and show no signs of diminution. The system which has enabled him to do this is deep and thorough cultivation (by steam) combined with an extensive use of artificial manures, *e. g.*, a very fine crop of barley which I saw, had been manured with artificials to the value of £2-5-0 per acre. No stock is kept except a few horses for carting, &c., and one cow for dairy; this condition is very similar to that of the Indian ryot, who in general only keeps stock for draught purposes. Mr. Prout's results show that continuous corn-growing may be made remunerative and not injurious to the land, where a supply of artificial manures is available and is properly used ; they are also interesting as being a practical application on a large scale of the teachings of the Rothamstead experimental plots. The system can never be fully followed by the Indian ryot, for he will never, as far as we know or can foresee now, be able to obtain a supply of artificials at a price which the market value of his crops will enable him to give; but in one respect he may well be urged to follow Mr. Prout, and that is, in deep and thorough cultivation; and if he did so, the results would be most beneficial to himself and to his landlord—the Government.

Since the last special report on operations of the Agri-Horticultural Society of Madras, furnished to Government under date 27th November 1878, this Society has not relaxed its efforts to perform its self-imposed public work, and to confer such benefits on the public as lie within its sphere, those efforts being, however, often cramped by the necessity for husbanding its resources.

During the time referred to, the Society has introduced, experimented with, or distributed, in addition to curious and ornamental plants, large numbers of valuable trees, plants and vegetables of known economic value, particularly Persian Date Palms, the Copal Varnish Tree, African Oil Palms, Mahogany, Landolphia, Ceara Rubber, Carobs, Brazil Nuts, Sapacia Nuts, Queensland Nuts, Water Chestnuts, Cocoa, Chinchona, Cloves, Nutmegs, Liberian Coffee, Bhamie Cotton, plants for fibre and paper-making, Eucalypti, and grasses and fodder plants.

Ploughs, scythes, galvanised wire, canvas and rubber hose for irrigation, pumps, syringes, and other agricultural and

horticultural implements have been imported, or obtained, and distributed to various places in India and Burmah.

Gardeners have been engaged and sent to employers in India and Burmah; and many boys are constantly being trained in the gardens.

The already *magnificent* botanical collection belonging to the Society is being almost daily added to, and a new Botanical Garden has been laid out and maintained.

A very extensive correspondence on botanical, arboricultural, agricultural and horticultural subjects has been kept up for the purpose of diffusing information; and the monthly Proceedings of the Committee have been regularly printed and distributed to members of the society, other similar bodies, and to persons interested in the various subjects to which they refer.

Publications on economic plants and their culture, and catalogues of plants and garden and other requisites have been obtained from, or voluntarily sent by, the publishers and added to the Society's library (which, though limited, forms a much used source of information on arboricultural, agricultural, and horticultural subjects), or sent to persons requiring them.

Botanical specimens are given freely, whenever asked, to local professors and lecturers, and scientific visitors, and the Botanic Garden is believed to be of great service to the students of the various botanical classes.

The Society acts, and is largely employed, as an agency through which persons at a distance obtain supplies of fruit, avenue shade, and other trees, plants and seeds, and annually obtains and forwards to all parts of India, and often abroad, large quantities of grafted mango and other trees, and seeds of many useful plants, particularly Inga Dulcis, Casuarina, Cotton, Tobacco, Senna, Forage-plants, and Maize, and other cereals.

The Society is often honored by references from Government and the Board of Revenue for information on horticultural and kindred subjects; and is frequently able to be of use to Commissioners, Collectors, and other authorities in distant provinces.

The increasing interest of the natives in the objects of the Society, and their marked success in imitating its European supporters, may be gathered from the number of prizes won by them at the Society's Annual Shows, as detailed in the lists annexed to the Annual Reports; while the sale-books show that if the natives do not join the Society as members in such numbers as is desirable, they contribute handsomely to its support by being large purchasers of seeds, plants, &c.

It will be observed that the Society has no grant from Local or Municipal Funds, and that Rs. 500 out of the Rs. 3,500 annually received from Government is a special grant dedicated by Government to prizes for useful products. The Committee has reason to believe that the Society's medals offered from this fund are much coveted by planters and manufacturers, and observes that success in obtaining them is frequently advertised as a proof of excellence.

BARLEY CULTIVATION FOR INDIA.

(Communicated)

(Continued from page 91.)

Climate.

Barley will flourish best in a temperate climate; but being hardy and having various species and a large number of varieties scattered throughout the world, it will grow in wide ranges of temperature. The frost of Indian plains does no injury whatever to the indigenous varieties, much less to barleys of the colder regions. The Indian plains and the hills are admirably suited to barleys of all varieties and of all parts of the world.

Time of Sowing.

The same as for wheat—*I. A.*, Vol. VII., No. 4, p. 116. I might as well note here, that the native cultivators of Upper India sow barley from the middle of October to the middle of November.

Geographical Distribution.

The genus *Hordeum* is a native of Asia, extending from the Caucasus mountains all along the east coast of the Mediterranean Sea down to the extreme south of Arabia, in the west side of Asia to China and India in the east, stretching northward to Siberia. The *African* barleys originally came from Arabia, and its northern neighbour, Palestine. From some centuries back by means of extensive cultivation and botanical researches, the most approved species with their varieties, have been introduced into various countries of Europe, America, Africa, and even the inhabited parts of Australia. It is, indeed, very surprising to find India has introduced none of the varieties of barley other than what it has from days of yore. I experimented with some of the most approved varieties of the two-rowed, four-rowed, and six-rowed barleys imported from Europe, Africa, Arabia, America, and the Indian indigenous, which succeeded well in the sandy soil and variable climate of Lucknow and Sitapore, and altogether well on rich soil artificially made at these places, from which I believe all exotic barleys, from other parts of the world, will grow remarkably well in India extending, from the hot plains, upwards to 15,000 feet in the Himalayan mountains.

Soil.

Ordinary agriculturists, on account of their finding barley growing and yielding a fair crop (according to their estimation of fair crop) on poor sandy soil, on which wheat and many other crops would fail, pronounce barley to require a poor soil, much sand, little clay, little or no manurial ingredients, and so forth. This is on account of the sturdiness of barley which certainly deserves better treatment. I have grown barley, and grown it experimentally, I might emphatically say, more than any one, past or present, in India; and from all the data I have gathered about the appropriate soil for this very valuable and badly treated plant from personal experience, can testify that barley requires, if a bumper and nutritious crop be the object, very rich soil—the same as wheat, barley differing from this best of cereal grain plants in this, that wheat will not grow and yield without the nitrates present in the soil, whereas barley will, because barley draws nitrogen from both the atmospheric air by its upper axis and from the soil by its lower axis—*i.e.*, by means of its root fibrils, wheat drawing nitrogen by means of its root fibrils only. Should, however, nitrates be present in the soil, barley will be grateful and repay by yielding a still greater bumper crop. *Loamy soil* of the *calcareous order*, and of the species having less lime and more humus.

Composition of soil:—

Clay	... 50	parts.
Lime	... 4	„
Humus...	... 5	„
Sand	... 41	„
Total	... 100	

Chemistry of the Barley Plant.

The chemical constituents of the produce of one acre of this plant (*vide* heading *yield*) will be found from the following tables:—

	Organic matter. lbs.	Inorganic matter. lbs.	Total. lbs.
Seed	1,58,016·933003	4,041·305826	1,62,958·299429
Leaves	1,16,115·366344	6,098·470456	1,22,213·836800
Total ..	2,75,032·299347	10,139·836282	285,172·136239

Chemical analyses of the inorganic portions of the foregoing:—

	Seed. lbs.	Leaves, stem, &c. lbs.	Total. lbs.
Oxide of potassium ...	854·344736	684·248385	1,538·593121
Chloride of potassium	228·337169	...	228·337169
Chloride of sodium ...	40·817795	130·507268	171·325063
Lime	66·682536	353·101440	419·783976
Oxide of magnesium...	293·403159	164·658702	458·061861
Oxide of iron ...	86·081092	82·939198	169·020290
Phosphoric acid ...	1,154·618217	439·089873	1,593·708090
Sulphuric acid ...	77·100087	66·473328	143·668415
Oxide of silicon ...	1,239·891035	4,177·452262	5,417·343297
Total ...	4,041·365826	6,098·470456	10,139·836282

Chemico-physiological Remarks.

Had it not been for the pretty thick husk or skin adhering to the seed, barley grain would have the smallest percentage of mineral matter not exceeding one per cent; including the husk it has 2·48 per cent, the stem, &c., having 4·99 per cent of it. Of the *organic* matter the grain has 97·52 per cent; and the stem, &c., 95·01 per cent. Small as these percentages of the ash might appear, the quantity of it carried off the acre is quite large, equal to a cart-load which can only be drawn by a pair of very strong bullocks. This quantity of the mineral constituents of the barley plant must be present in the soil of one acre, and in a form the root-fibrils will imbibe them. If these precautions be not observed in barley cultivation, the cultivator can never hope to crop a bumper crop for which he is always trying. It might also be noted that the barley plant (equally applicable to all other plants), draws a good portion of its organic constituents from the atmospheric air, but the remaining portion must be present in the soil without which the plant will not grow; because this plant draws its food by means of the upper axis as well as by means of the lower axis. These points respecting barley and several other plants have been thoroughly established beyond dispute, by innumerable chemico-physiological experimental demonstrations.

Barley is pretty rich in the metal potassium—as an oxide, the seed has 21·14 per cent, and the stem, &c., 11·22 per cent, of this metal; and as a chloride, the seed has 5·65 per cent, but there is not a particle of chlorine in the stem, &c. The metal sodium is found in combination with chlorine—seed 1·01 per cent, and the stem, &c., 2·14 per cent—a very small percentage: no oxide of this metal is found in this plant. Barley seed is very poor in lime, the stem having more of it for building of its tissues in combination with other elementary substances, seed 1·65 per cent; and stem, &c., 5·79 per cent. Magnesia is more abundant than lime, in this plant; seed, 7·26 per cent; stem, &c., 2·70 per cent. It is remarkable to find so much as 2·13 per cent in the seed, and 1·36 per cent in the stem, &c., of iron, in combination with oxygen, present in barley. Barley is very rich in phosphoric acid, which in quantity ranks second of all elements found in the ash of this plant, silica ranking first—28·57 per cent, and stem, &c., 7·20 per cent. There is more sulphuric acid in the seed than chloride of sodium, but less in the stem—seed 1·01 per cent; stem, &c., 1·09 per cent. Of silica the grain has 30·68 per cent; and the stem, &c., 68·50 per cent. The abundance of silica and potash in the grain is on account of the thick husk adhering the kernel.

Barley belongs to the *silica order*.

Starch, Gluten, and Malt Principles in the Barley Plant

A knowledge of the intrinsic value of a plant is essentially necessary for a cultivator beforehand, because such a knowledge will be his guide in the sale of his produce, and he will know what kind of reception his produce will find at the hands of the purchasers and consumers: also he will be in a the position not to be duped and overreached by them. To experimenter this knowledge is essentially necessary to enable him to judge of the results of his experiments, *i.e.*, whether he has succeeded or failed to improve the plant he has cultivated. The quantity is nothing, for if it were so, grass would have vied with grapes, all success lying in quality. The native cultivators, as a rule, do not pay attention to the quality of their produce, hence the extensive degeneration found in the vegetable kingdom (cultivated) in India. Brooding over this matter, I think a concise account of the organic principles found in the barley grain (the most important part of the plant) will be found useful and interesting, having already given a detailed account of the ash constituents of this plant. I accordingly proceed to give an account of what I have herein mooted.

The kernel of barley grain, like that of wheat, has two organic substances, having small percentages of mineral matter, known to chemists by the name of *starch* and *gluten*; and when a chemical reaction is produced on them in the process called *malting*, other substances are formed denominated *malt principles*. I will describe each of these separately.

Starch.

This substance is very abundant in the barley grain, resembling in outward appearance the other starches found in wheat grain, rice, different palms, and several roots and tubers: on feeling and microscopic examination, however, barley starch differs in its granules from all other starches. Herein lies the microscopic detection made perfect by chemical analysis by which the constituents of the starch is thoroughly ascertained. Barley starch is a white, soft, powdery substance easily separated from the other substance, gluten, by kneading the flour in water, *i. e.*, the flour is first made into a lump by moistening it with water, and then water gradually added as kneading proceeds, until the gluten is entirely separated from the starch as a sticky substance, and the starch remains mixed in the water, gradually subsiding, leaving the surface water clear. This can only be done by allowing the starch-water to be at rest for some time. After the starch has subsided, the water should be drained off, the starch collected, dried artificially, if accuracy is required, at 75°C, or under a strong sun, weighed, again dried, and again weighed, repeating this procedure several times until the weight be found unaltered. The last weight indicates the quantity of starch in the flour.

It should be noted that starch does not contain an atom of nitrogen; the abundance of starch in the barley grain, therefore, forms no criterion of barley-corn as food-grain.

Gluten.

Gluten is the other substance found in the barley grain, and is the one on which depends the intrinsic value of barley as food-grain. It is a nitrogenous or blood-producing principle existing in the largest quantity in wheat grain, hence the value of wheat over all other cereal grains as food for man and animals. Starch alone cannot nourish the animal body, for though the large quantity of carbon present in starch is essentially necessary for animal economy in the formation of bile, without which no chylification can take place, yet without gluten no blood and muscles, &c., can be formed. Hence, nature has provided this latter substance very extensively in all food-yielding plants. Another value of gluten is that without it no bread can be made; and according to Mr. Dumas, unless more than 14 per cent of gluten exists in the flour, it is impossible to make bread. The intrinsic value of barley therefore consists in the quantity of gluten it has; the more gluten the more valuable it is: the less, the less. Up to the present time chemists have not fixed the percentage of gluten which should exist in the cereal grain as a commercial standard of intrinsic value of the grain. For barley I think 25 per cent of gluten ought to be considered as maximum; and 50 per cent for wheat. Gluten is obtained in the manner described above: also dried and weighed like starch. Every experimenter and cultivator should try to increase the quantity of gluten in barley and wheat grain. I find Indian barleys very deficient in gluten, not exceeding 10 per cent; also a variety of wheat known by the name of *jamnapari*, a variety of the red hard wheat, grown in tracts of Upper India bordering the Jumna, hence the name. This wheat scarcely has more than 14 per cent of gluten, on which account it makes very bad bread, cannot be stretched and shaped properly, and of course is not nutritious. It does not find a ready market in any part of Upper India.

There are chemical elaborate methods of separating starch and gluten, and for ascertaining their weight. They are tedious and impracticable to those who are not analytical chemists. The processes herein described are very simple, not very accurate in the result, but perfectly within reach of every one and everywhere.

Malt Principles.

By fermentation, starch and gluten of barley corn are converted into new substances, *viz.*, *asparagin*, *protein compound*, *distase*, *cholesterin*, *fat*, and *acid*. These are the *organic* principles found in beer and porter, to which are added several others by the admixture of foreign substances, of which a small percentage of alcohol is always present. Beer and porter are slightly nourishing, stomachic; and intoxicating, if taken in large quantities; harmless drinks or beverages, valuable for females who nurse their

own or others' children. The therapeutic properties of these beverages is *anti-scorbutic*, and are extensively prescribed by the medical profession. These are costly drinks, however.

Ploughing and weeding, same as for wheat, *Indian Agriculturist*, Vol. VII, No. 4, p. 117.

Beds and water channels, same as for wheat, *Indian Agriculturist*, Vol. VII, No. 4, p. 117.

Selection of seed, same as for wheat, *Indian Agriculturist*, Vol. VII, No. 4, p. 117.

Sowing, same as for wheat, *Indian Agriculturist*, Vol. VII, No. 4, pp. 117-118.

Quantity of seed required for sowing one acre, same as for wheat, *Indian Agriculturist*, Vol. VII, No. 4, p. 118.

Habits of growth and remedy, same as for wheat, *Indian Agriculturist*, Vol. VII, No. 4, p. 118.

Irrigation, same as for wheat, *Indian Agriculturist*, Vol. VII, No. 4, p. 118.

Harvesting.

Like the wheat, barley ear is not provided with glume as an outer protection of the grain, and therefore, if the grain be thoroughly dry on the ear, it is apt to fall down by the slightest touch or even by the action of wind, or by the fall of rain, and get lost. Hence barley requires harvesting at a time when the grain, though thoroughly mature, is not perfectly dry. The best time for harvesting this plant is early in the morning or when the sun is down; should, however, the ear be found in a state capable of being harvested during the day, barley might be harvested even during the day. If the sheaf be broken, wheat cannot get lost, but barley will: the greatest care is therefore necessary both in the time and in the manner barley is harvested. It must be remembered that no rough handling will do for barley. A bunch of barley plant, in the lightest manner, should be drawn with the sickle, firmly grasped with the left hand, and with the right hand cleanly cut out as near the ground as possible without disturbing other plants. This can very easily be accomplished by means of a very sharp sickle. The native sickle cannot do it. It is a blunt, badly-shaped tool made of maleable iron, with a rough handle. The sickle should be of a semi-circular shape, manufactured of pure steel, *case-hardened*, and the cutting part formed and sharpened like a barbers' razor.

The produce of one bunch (selected) of barley produced by me at Sitapore sudder station during the *rubbee* season 1871-72 which having received, in every respect, the kind of cultivation described in this article, contained 100 sheaves, each sheaf, on an average, containing 60 grains. This produce was thoroughly dried, grain separated, and then weighed. The weight was found to be as follows:—

			Ch.	Tolas.
Seed or grain.	...	...	3 —	1·67
Traves, stem, etc.	...	...	2 —	2·502

Based on these figures the produce of one acre will be found from the calculations given below:—

	Ch. T.	Mds. S. Ch. T.	Rs.
Grain	=(288 × 1,320) × (3-1· 67)	=1,980-15-13 2· 2	=162,958·2,99,429
Leaves, Stem, etc.	=(283 × 1,320) × (2-2·502)	=1,485- 9- 8- ·32	=122,213·8,30,800
Total. ..		3,465-25-5-2·52	=285,172·1,30,229

These should be accepted as reliable maximum data as guide for calculation of manure for one acre of barley on the formula given by Baron Liebig (*vide* heading, *Application of Manure*, of the wheat article. *Indian Agriculturist*, Vol. VII., No. 4, p. 117).

O. L. BRYCE.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

THE Annual General Meeting was held on Thursday, the 1st March 1883.

W. H. Cogswell, Esq., President, in the Chair.

The Proceedings of the last (January) meeting was read and confirmed.

The following gentlemen were elected Members:—

Messrs. F. D. Bellew, S. R. Elson, J. Leadbeater, and the Maharaja of Mohurbhunge.

The names of the following gentlemen were submitted as desirous of joining the Society:—

A D. M. Morrison, Esq., Merchant, Calcutta,—proposed by Mr. W. H. Cogswell, seconded by Mr. S. H. Robinson.

Munshi Mado Lall, Zemindar, Munsif of Mirzapore,—proposed by the Raja of Kuntil, seconded by the Secretary.

Major E. C. Corbyns, Deputy Commissioner, Shahpore District, Punjab,—proposed by the Secretary, seconded by Mr. J. E. MacLachlan.

Major F. R. Lowis, R.A., Calcutta,—proposed by the President, seconded by the Secretary.

R. R. Waller, Esq., Merchant, Calcutta,—proposed by Mr. S. Cresswell, seconded by Mr. R. Blechyndon.

Miss DeMomet, Dooteriah Tea Garden, Darjeeling,—proposed by Mr. John Stalkartt, seconded by Raja S. A. Ghosal.

D. J. Zemin, Esq., Calcutta,—proposed by Dr. G. R. Ferris, seconded by the Secretary.

H. J. Joakim, Esq., Merchant, Calcutta,—proposed by Dr. Ferris, seconded by the Secretary.

Rejoined—Dr. G. R. Ferris, Calcutta; Mr. R. J. Carberry, Calcutta; Mr. A. G. Watson, Mr. T. M. Francis, and the Proprietors of the Jugdispore Estate, Beheea.

Annual Report.

The Report for 1882 from the Council was read. The Report first enters into details connected with the internal economy of the Society (showing that the number of Native Members is less than one-sixth of the entire list,) and its financial operations, and closes with notice of flower show, garden, &c. The following are extracts on these latter topics:—

"The usual Annual Flower Show was held on the 3rd February, and was equally as successful as that of the previous year, indeed more so in one respect, as the quality of the plants submitted, especially of handsome foliaged ones, was superior to any previous exhibition. The number of visitors (1,500) was beyond the average. The space allotted to each class of plants being extended, admitted of a better arrangement than previously: more time was also allowed for the introduction of specimens. The sum of Rs. 414 was awarded from the general fund besides Rs. 67 from the sum of Rs. 100 placed at the disposal of the Judges by the President.

"*Garden.*—The stock of fruit grafts, especially of certain kinds most in demand, has been much increased during the past year, which will admit of a much larger distribution than formerly; it is anticipated that the supply will prove fully equal to the demand. This remark is also applicable to Roses, a class of plants for which the demand greatly exceeds that of any other kinds. Some of the newest varieties have been recently introduced which will be in course of distribution during 1883-84.

"Much time and labor have recently been devoted towards a general clearing up of the garden and the removal of several large trees and shrubs, of which there were many specimens occupying a large space of ground which has been better utilized by Rose and other plants much in demand. The majority of these trees were introduced ten years ago to fill up vacant spaces on the formation of the garden.

"The distribution of plants is not equal to last year which indeed may be considered an exceptional year; but it has not fallen short of previous years. Rather more than ten thousand ornamental plants have been issued to members and the public, besides certain economic plants and cuttings; of fruit grafts two thousand five hundred have been sent out. A good many plants have also been granted in exchange and to hospitals and asylums.

"Several subjects have engaged attention, especially those relative to cotton, fibres, and the introduction of superior kinds of potatoes. These matters and many others having been introduced into the monthly proceedings need not be reproduced here, except to notify the fact that in July last the President prepared a full and carefully worded circular letter which was sent to as many as eighty native noblemen, chiefs, and landed proprietors, throughout the country, together with a copy of the last published number of the Journal. The Council have to notify, with much regret, that as yet three only have responded to the suggestion that their names should be enrolled on the list of members. The Council regret to have to reiterate the fact that, while education is rapidly spreading throughout India, the large body of intelligent Hindoos and Mahomedans have not, with very few exceptions, shown that interest in the proceedings of the Society which might naturally be expected from a class who would derive the most benefit. The Council would also be glad if the European members would endeavour to induce their friends to join, so as to fill up the gap annually caused by deaths, resignations, and departures from the country. It has been more than once observed in previous reports that if each member would undertake to add one friend annually to the list, that list would soon be doubled. The Council would, in conclusion, bring this fact again to the notice of members in town and country and urge their hearty co-operation."

At the conclusion of the reading of the Report, the President addressed the meeting as follows:—

Gentlemen,—I feel that the Annual Report for last year, just read, embraces so much and deals so fully with the affairs of the Society, that very little is left for me in the way of comment thereon, but there are a few points on which I wish to touch as briefly as possible.

The Report alludes to the efforts we have made to reach the large number of native noblemen and wealthy influential landed proprietors to join our Society.

It is shown that there were eighty of them addressed, and that out of that large number, three only have responded favourably to our representations.

Surprise only at such a result does not convey my feeling, which is also one of great regret that such indifference characterizes those who should be foremost in fostering a

Society, whose aim and object are the furtherance of landholders' interests, in the improvement of their estates, by a higher and better cultivation of their land, by the use of well selected seeds, and as a natural result, a better and larger yield of crops, and a richer harvest to themselves and to their tenants.

It is doubly disappointing when we think that among such gentlemen there is no lack of leisure, means, and ability, and doubtless in many cases, the taste and application needful to devote to such objects, with successful results; and although I am at a loss to understand such apathy, I still look to that wealthy community with a feeling of confidence that amongst their fixed resident ranks, many may be yet influenced to join us and take an active part in the great and good work initiated and prosecuted with zeal by a few, whose good example should be followed, for they have comparatively but a passing interest in this country, whilst those to whom I allude are in their native land, and with every inducement to come forward and take an active part.

This is the more necessary, for socially, a great change has taken place. The European has become more than ever a bird of passage than formerly, With some exceptions, men are less public spirited and have less time at their disposal. The battle of life is greater, competition is keener, and they have less time to give for the benefit of public institutions; but independently of these facts, there is certainly much less public spirit generally, and not that inclination to devote a portion of what is taken from the country for the benefit of the country This, I think, holds good with few exceptions, among the higher classes of the official community, who draw so largely from the State. The more rapid communication with Europe has no doubt greatly contributed to this state of things. In former years a young man entering the service of Government commenced life under the impression that he would probably have to work for a certain length of time in the country undisturbed, and that he should give a portion of such time, independently of official work, towards the benefit of those among whom his lot was cast. This feeling was shared by military men in civil and political employ, as well as by civilians generally; now, the object appears to be to endeavour to accumulate wealth and to retire on as early a date as possible, and all our public institutions suffer more or less from this state of things; hence the greater necessity for the native wealthy landed proprietors and others to come forward and take their place and stand in our ranks, and become interested in such work as would redound to their own credit, and whilst forwarding their own interests, they would benefit their country at large.

The Society's records are flooded with valuable information, and bear testimony to the great benefits this country has derived from its labours and influence during the past half-century: records of good work done which cannot be forgotten, and requiring only the support and encouragment of those to whom I have alluded as an additional reform, or adaptation, to meet the new times and enable the Society to increase in the number of its adherents, in its wealth, and in its great influence, and for the accomplishment of which I appeal to all those who have its interests at heart to continue unflagging their efforts to further its prosperity.

With these observations I have pleasure in proposing the adoption of the report.

The report was unanimously adopted, and the best thanks of the meeting were voted to the President for his interesting and appropriate remarks. The election of officers and council was next entered on with the following results:—

President.—Mr. W. H. Cogswell.

Vice-President.—Raja Suttyanund Ghosal Bahadoor, Mr. W. Stalkartt, Mr. H. A. Firth, and Baboo Protapa Chundra Ghosa.

Secretary.—Mr. A. H. Blechynden.

Council.—Mr. J. E. MacLachlan, Mr. R. Blechynden, Dr. G. King, Dr. S. Lynch, Baboo Peary Chand Mittra, Mr. S. Cresswell, Maharaja of Cooch Behar, Mr. G. L. Kemp, Mr. S. H. Robinson, Baboo Joykisson Mookerjee, Mr. John Martin, and Mr. D. Cruickshank.

Horti-Floricultural Exhibition.

The reports of the judges on the annual show of vegetables, fruits, and flowers were submitted as follows:—(Judges: Dr. S. Lynch, Mr. W. Stalkartt, and Mr. John Lynam).

Horticultural.—The exhibits for which prizes were offered on this occasion was on a comparatively limited scale on account of the limited space at disposal, not more than 14 kinds of vegetables and twelve of fruits. The quantity in each basket was also limited. Notwithstanding the announcement being widely notified to the intending competitors, many baskets contained more than the prescribed number, and several other kinds not in the list (notably, cauliflowers, turnips, knolekole and cabbages) were introduced into the tent. Though some of them were well grown specimens, the judges were not in a position to award prizes to them. However, in some instances, they did not think it desirable to adhere strictly to the rules laid down as to the number of each kind, this being the first attempt, under the new system, of restriction in quantity.

Among the vegetables, there was a marked improvement in celery. Carrots and potatoes were also well represented, and artichokes (out of season). Tomatos and beet were excellent. Peas and French beans were fairly good.

In the list of fruits, bael showed well; there were some good specimens of pine-apples, papyas, and guavas—though out of season. A special prize was awarded for a small China orange tree laden with fruit.

Altogether the show was satisfactory, fifty market gardeners competed and fully 350 baskets where shown. Prizes were awarded to 24, amounting to Rs. 160, of which Rs. 99 were for vegetables and Rs. 61 for fruits.

Floricultural.—(Judges: Dr. G. King, Messrs. G. L. Kemp, H. A. Firth, and Raja Suttyanund Ghosal Bahadoor.)

The collection of plants was rather less than last year, but the quality of those exhibited was equally as good, and in some instances better. The competition was much the same—18 gardens of whom 14 gained prizes. There was a good collection of handsome foliage plants, notably crotons, dieffenbachis dracænas, marantas, anthurium, aralias, begonias, including several new kinds. The collection of cut flowers, especially roses, was excellent—far superior to last year. One collection of roses from the garden of Mr. G. A. Forbes at Barrackpore deserves special mention, but no prize could be awarded to it as it was sent too late. Among the annuals were good examples of asters, pansies, violets, and verbenas.

The Royal Botanic Garden contributed a very interesting and much larger collection than last year, occupying seven stands, of three tiers each and 9½ feet in length. Of many fine plants the following may be mentioned as among the newer—namely, piper magnificum, anthurium, warocqueanum, dieffenbachia marmorata,* D. parlatorei, D. maculosa, D. Brazilienis, aralia veitchii, A. elegantissima, selaginella magnifica, S. paradoxa, dracæna benthami, philodendron carderi, heliconia auroo-striata, phyllagathis rotundifolia, lindsaya pectinata, sphacrostemma marmorata, allomorphia griffithii, dichorisandra musaica, trenesia moluccana, ptychosperma singaporensis, schismattoglottis longispatha, and centrasclenia aurea.

There were three commpetitors for the "Grant Silver medal" for the best collection of plants or flowers of any number of kinds. The medal was awarded to Baboo S. P. Chatterjee.

Extra prizes to the value of Rs. 51 were awarded from the sum (Rs. 100) placed again by the President at disposal of the judges for rare or well grown plants not included in the schedule, and Rs. 411 were awarded for the latter. A detailed list is hereto annexed.

The attendance of visitors was less than last year, attributable probably to its not being a public holiday Their Excellencies the Viceroy and the Marchioness of Ripon, and his Honor the Lieutenant-Governor and Mrs. Rivers Thompson honoured the show with their presence.

The thanks of the Society are due to Colonel McNair and the Officers of the 4th Regiment N. I., for the services of their band on the occasion.

A report from the Garden Committee was introduced and adopted in respect to provision of vegetable, flower, and agricultural seeds for next season from Europe, America, and Australia.

Maize or Indian-corn.

The Secretary submitted the following few notes which he had prepared in connection with some cobs or ears of Indian-corn, which had been recently sent down from Tirhoot:—

Colonel Money, the Manager of the Durbhunga Raj, has sent us two cobs of maize raised in the Raj Garden. It appears from their size and general appearance that they have been raised from imported seed; probably from the kind we import from Philadelphia as "Yellow Canada," to which they are fully equal in every respect. [I placed those on the table at our show on the 7th February, and so highly were they appreciated that they were stolen by one of our many visitors, the sheaths only being left behind.] I have requested Colonel Money to inform us of the stock from whence derived, the soil in which grown, and the manure employed. If maize of this character can be raised in India in any quantity, we should be able to compete successfully with the United States in the English market.

It would appear that the quantity of Indian-corn taken by England from abroad, chiefly from America, in 1881, was upwards of 33 millions cwts., or considerably more than half the total imports of wheat. In a recent article in the *Englishman* it is stated that "the shipping of Indian-corn in merchantable quantities began in the latter end of December last, but was discontinued early this month (February), owing to the want of supplies of a sufficiently good quality. During this short period between twelve and thirteen thousand bags were shipped; and when the new season begins next month, a very large business is expected. This business can, however, be but insignificant compared with what it might be if the Government of the country were properly alive to its true interest in establishing cheap communications between the coast and such rich, but isolated, tracts, as the greater part of the Central Provinces, which are alone capable of supplying all the Indian-corn England requires, without any serious rise of prices. Here is a potential addition to our export trade of probably not less than five millions sterling per annum, which only needs a little more enterprise for its realisation."

Referring to the above remark as to the capabilities of the Central Provinces, in which may be included Central India, I may observe that many years ago (1838 or 1839) Colonel Dixon, then Superintendent of Ajmere and Mhairwarra, called the attention of the Society to the very inferior size of the Indian-corn raised in those districts. At Colonel Dixon's request the Society forwarded him large quantities of imported American seed for several consecutive years which he reported had greatly improved the character of their stock. Whether it has since deteriorated I am unable to say, but am making enquiries thereon.

The outer sheaths on these cobs, of which it will be seen there are many enveloping each cob, and which are now either thrown away or used as fuel, would most probably prove a valuable addition to our stock of paper-making materials.

Whilst penning these few notes, I have received a useful contribution from Captain Pogson, on "Maize as a paper-producer," which I introduce here in connection with the above remarks, so as to render our information more complete and interesting.

"Maize is cultivated all over India, but partly from want of knowledge and partly from want of organization, the portion of the cob which yields a superior material for manufacture into paper is almost as a rule burned. In Germany, Austria, and Hungary, a very superior kind of paper is made from the sheaths or envelope of the maize cobs. Maize paper has none of the brittleness peculiar to ordinary straw paper. Maize paper appears to be the most unexceptionable of the papers not made from rags. Not only is it remarkably tough, but it is devoid of all the silicious matter which proves so embarrassing in ordinary straw paper, causing great brittleness when folding and rapidly destroying the face of printers' type. The extreme toughness of the paper makes it particularly eligible for Bank note paper and for the purpose of envelopes. The colour is somewhat yellowish, but it is easily bleached."

This really valuable information (whence derived is not stated) is all but lost in 4½ columns of matter connected with maize cultivation, and to be found in the *Indian Agriculturist* for September 1881, at page 250.

There is a first class paper mill at Lucknow, and the Maharaja Scindia started a paper mill now in the market. Now if any suitable organization existed, all the maize cob sheaths produced by the zemindars of Oudh, might be made to find their way to Lucknow, for conversion into superior paper, and in like manner, if Scindia's paper mill was set up in the Allyghur district, on or near the Ganges Canal, all the maize grown within 50 miles on each side of the Canal would yield up their cob sheaths to the paper-maker, and we should see Upper India producing first class paper from what is now looked upon and treated as a valueless waste substance.

The Agricultural Department could very easily cause it to be made known that if the zemindars preserved the Indian-corn cob sheaths, purchasers would be found for the article, and then one paper mill would not suffice to work up the material made available from Hurdwar to Allyghur, leaving all below Allyghur to be utilized at Cawnpore, where another paper mill should be started.

There is ample money in the country to carry out the project, and if ventilated through the proceedings of the Society, would carry great weight. I venture to predict that the thing would be done.

Since the above was written, I have had a communication from Mr. Maries, of the Raj Garden, informing me that the maize he has sent down was grown in light garden loam, and cow and horse-dung used in trenched ground about 15 inches. Seed was sown in September, fit for use in December, and was obtained from Veitch and Sons, London, as Canada early Maize. The cobs sent were not selected ones, the whole crops being alike.

And Mr. Parsons, the Superintendent of the Ajmere Garden, has kindly afforded me the following particulars in response to my application :—"The maize grown in the immediate neighbourhood is a very small yellow kind, both cobs and the grain itself being inferior in appearance. In favourable seasons, however, good crops are obtained from it. This kind has, I am told, been cultivated from time immemorial. I am further informed that Colonel Dixon sent the maize he imported into Merwarra, where there is now a white kind grown said to be not indigenous to the district. It is not, however, brought into this part for sale, and I have not seen it myself. Should this be correct, it seems strange that it was not established in the Ajmere district also. I have been over a considerable part of it, but have never met with any kind but the one I have referred to. Mr. Saunders, the Commissioner of Ajmere, Merwarra, is now on tour in the last-named district, and I have sent your letter to him. If he can procure further information on the subject, I will write again on hearing from him."

RESULT OF TRIAL OF KIDNEY POTATOES IN THE NURSERY GARDEN WITH POTATOES RAISED IN AMERICA FROM ENGLISH STOCK.

A report from the Garden Superintendent (dated 20th February) was read, in respect to the culture of certain potatoes presented in November last by Mr. W. Stalkartt :—

"The receipt of, and planting out, of these potatoes has already been reported on. The supply, presented in a small box, was too far advanced towards germination to admit of weighing or the least rough handling ; but for practical purposes it may be correctly considered the presentation weighed four seers. The space occupied by the potatoes in the box having been refilled with fresh gathered potatoes and weighed, the result being four seers.

I am sending up a small quantity of earth to show the soil the same was grown in, which is not too stiff, reasonably light and friable. The potatoes were planted out entire, uncut, as in that state I considered them less susceptible to mildew, rot, and attacks of ants, a handful of old well rotted cowdung being placed round the tubers. In the course of three weeks the vines having well developed, were earthed up, an additional handful of similar manure being supplied. Watering was continued from date of planting pretty freely, till the beginning of this month (February), when the supply was gradually lessened, my main object being to avoid the possibility of the vines flowering. A couple of days since I observed red ants, and unearthing found the mischief to the potatoes had begun. All the potatoes were unearthed yesterday, and the following is the result :—

Sent to Secretary's office on 19th February 1883	...	1 seer	good potatoes.
Sent to Secretary's office on 20th February 1883	...	18½ „	„ „
Sent to Secretary's office on 20th February 1883	...	1½ „	small „
Sent to Secretary's office on 20th February 1883	...	4½ „	attacked by red ants;

The vines had not withered when the potatoes were gathered, but I could not defer the same owing to the red ants ; I should much wish to plant out a similar quantity early in October next, which I think would be a most favourable time for experiment.

Many of the tubers are as large as those put down. I boiled a couple and found them of good colour and flavour."

Mr. Stalkartt showed some fine specimens of potatoes raised in his garden from the above and other kinds. Mr. West exhibited some well grown seedling tuberous rooted *begonias* in full flower.

Mr. Maries sent down from the Durbhunga Raj Garden some fine cut flowers of pansies, pinks, and stock.

AMERICAN SUMACH.

The secretary called the attention of members to the subject of American sumach or divi-divi (*Cæsalpinia coriaria*), in connection with a small quantity of seed recently gathered from a few trees in the Society's Garden, and to the enquiries now being made in respect to this valuable plant. He submitted a paper he had drawn up showing what the Society had done in the matter nearly forty years ago, and brought to notice certain skins tanned by the pods, and specimen of the pod itself, all which had been in the museum during this long period. He had prepared this paper to show that the Society had been the first in the field not only in respect to this, but many other useful products, which are now and again introduced as novelties to public notice.

The paper was transferred for publication in the number of the Journal now in the press.

MUDDAR PLANT.

The secretary submitted another paper on the muddar plant (*Calatropis hamiltonii*) and its useful properties, and laid on the table specimens from the museum of cloth made therefrom some 30 years ago. In the proceedings of the Society there occur several notices regarding this jungly plant which may not be generally known or are now lost sight of. Considering it might be worth while to reintroduce the facts, notified so long since for the information of readers of the present day, he had drawn up a few notes thereon. (Transferred for Journal.)

OFFICIAL PAPER.

ESTABLISHMENT OF FUEL AND FODDER RESERVES.

Extract from the Proceedings of the Government of India, in the Revenue and Agricultural Department,—Dated Calcutta, the 1st March 1883.

THE attention of the Government of India has lately been called by various reports and statistical returns from the Upper Provinces to the growing decrease in the area of grazing lands and wooded tracts in many parts of Upper India. These remarks have special reference to the Provinces of the Punjab, the North-West, and the Central Provinces, inclusive of the Berars. The grazing land in these provinces has not only diminished in area, but has also deteriorated in quality and changed character, the latter result being partly due, as will be presently explained, to the excessive grazing which the reduction in area has made necessary. The Government of India is aware that efforts have been made both by the Local Governments and district officers, especially in the Punjab, to meet the difficulty ; but it appears necessary that more systematic measures and arrangements should be undertaken than have yet been instituted in any province. The Famine Commissioners have not omitted to give prominent notice to the subject in Part II of their Report.

2. The decrease of the area of culturable waste is a natural consequence of the increasing numbers of the agricultural population, by whom a continually extended area of arable land is required for the plough. The argument indeed has been brought forward that the grazing lands and jungles, of which the cattle of the country have been deprived by the encroachments of agriculture, can be profitably and efficiently replaced by fodder crops, and that such has in fact been the case in many countries in which agriculture is more fully developed. But it is doubtful how far it is wise to allow this argument to be applied at present to the Upper Provinces of India. The one fact that these regions are subject to droughts of a character unknown in the Western hemisphere, places them on an entirely different footing from those civilised countries with the agricultural system of which we are most familiar. In a season when a failure of the monsoon causes the destruction of crops which supply food for men, those crops also upon which cattle depend are equally liable to perish. It is only in tracts which are thoroughly irrigated that any safe reliance can be placed upon a supply of artificially-raised fodder, or that a system of stall feeding can be expected to preserve the lives of the cattle,

Tracts so protected form at the present time a small proportion of the agricultural area of Northern India.

3. The history of the famines and droughts which have occurred during the present century, and especially in late years, is replete with painful accounts of the wholesale destruction of cattle by starvation and the failure of the fodder supply. It may be doubtful whether the loss which the agricultural population has thus sustained has always been fully appreciated. At a time when they have been deprived by a failure of the rains of a great portion of the produce of one or more seasons, they have also had taken from them, in the destruction of their plough-labour, the means of recouping their loss in succeeding years. The late famine of 1877 has furnished many examples of this kind. Accounts have reached the Government of India of the serious deterioration of the agricultural prosperity of many tracts which, there is every reason to believe, would now be in a flourishing condition if the cattle could have been saved. On the other hand, instances have been brought forward in which the existence of a sufficient area of grazing land has, in districts most affected by the drought, both preserved the cattle and secured the agricultural population from prospective loss.

4. It is desirable at this point to explain that the term "grazing land" as herein used, is not to be restricted to land which provides nothing but the ordinary pasture of a grass plain. Such land is often affected just as seriously by a drought as the unirrigated area of cultivated land. Grazing land is here intended to include those wooded tracts and jungles which provide bushes, trees, and herbs from which cattle can obtain a plentiful supply of fodder, even at times when the grass on open ground is dried up and destroyed. There are many trees and many bushes which, drawing upon a supply of moisture below the surface of the earth, can maintain their life and vigour when the shallow-rooted crops and grasses are parched and withered. And this is not all. It has also been ascertained that the grass itself which, on an exposed surface, would succumb to the drought, is, in the cooler atmosphere occasioned by the shade and protection of trees and shrubs, saved from destruction.

As, moreover, there is, apart from the question of fodder, a distinct agricultural advantage in maintaining throughout the plains of Upper India a supply of wood for fuel and domestic purposes, the term used in the following paragraphs of this Resolution to designate grazing lands will be that of Fuel and Fodder Reserves.

5. A further effect of the absence of proper food after a period of drought is that the cattle, which have been starved for weeks, feed too greedily on the young shoots of the millets that are sown with the first showers of rain, or on the coarse grass that springs up on the return of the monsoon. The excess of food to which they have been unaccustomed induces a rapidly fatal disease which has carried off thousands of animals in many parts of India.

6. Instances are quoted in which cattle perished in large numbers from want of fodder in the droughts of 1877 and 1880; while, on the other hand, cases are noted in which they were saved by being fed on bushes and leaves of trees. In Rohtak, for example, no less than 250,000 beasts are said to have died, or about one-half of the whole cattle of the district. This was in 1877. In 1880, 15,000 cattle are reported to have perished in the district of Jhansi, while many others were only preserved by the bushes in the ravines or by fodder obtained from trees. In the same year large numbers of cattle were in the Allahabad Division kept alive by being taken to the forest tracts of Banda, while throughout the division all the available trees were stripped of their leaves. "There is no need," writes the Commissioner in quoting from his district reports, "to multiply these extracts, all of which tell precisely the same story."

7. The examples to which reference has now been made are sufficient proof of the necessity of taking some action for the protection of the cattle of the country against drought. The facts brought forward seem to prove that at present the agricultural population will not or cannot themselves take sufficient precautions to provide against exceptional occurrences. They trust to accident or to assistance from the Government. But in this matter little or no help can be afforded, unless systematic arrangements are made in advance, and continuously maintained, under which a supply of fodder in a year of drought may be secured. It is necessary, therefore, to consider in what form, system and continuity can be most advantageously established; and it is on this point that the Government of India is mainly desirous of obtaining the advice and co-operation of Local Governments.

The general outlines of the scheme which commends itself to the Government of India as most likely to secure the desired results, and which from enquiries already made appears likely to meet with the most general acceptation, will be briefly described in the following paragraphs.

8. The general control and administration of the measures with which this Resolution is concerned should, in the opinion of the Government of India, be primarily in the hands of the local officers, *viz.*, the Commissioner, the District Officer, and his subordinates in charge of sub-divisions. The official channel through which the Local Government would communicate with the divisional and district officers would be the Agricultural Department, which would be responsible for providing the Government with advice and information, and for maintaining continuous action. The actual management of the lands set apart for the supply of fodder and fuel would be placed in the hands of Forest officials, who alone can be expected to establish and maintain without interruption a scientific system of treatment.

9. In order to satisfy the above conditions, it would be necessary, in each district or division in which operations are likely to be sufficiently extensive to require scientific management, that an officer of the Forest Department should, when financial circumstances admit of this being done, be placed under the orders of the district or divisional officer. He would work entirely under the orders of the Civil officer, who would, however, refer questions of a professional or technical character for the advice of the chief Forest Officer of the province or circle. In many districts the necessary staff exists already, but in other new posts will have to be created.

It must not, however, be expected that arrangements can be made, financially or otherwise, under which every district or division can, in every part of the Upper Provinces in which the measure would be useful, be supplied with a separate Forest Office for the work contemplated. It would, indeed, be extremely unwise to enter upon any expensive organisation until much more experience and information has been acquired. It is only, therefore, for those regions in which grazing lands are disappearing at a rapid rate, or in which history has shown that drought causes extensive destruction of cattle, that any application for the services of special officials could at present be entertained, It will probably be considered sufficient if at first a Forest official is attached as assistant to the Commissioner in one or two of the divisions in each province in which protection is most required.

10. In the meanwhile the serious duty will devolve upon the district officers of ascertaining how far the cattle need protection, and the extent of land, whether the property of Government or purchasable from land-owners at a reasonable price, which can be made available for fuel and fodder reserves. For this purpose an analysis of every district should be made by the local officials which will show its need for protection against drought, and the extent to which land is available for fuel and fodder reserves. They may also be directed to enquire how land can be most advantageously secured for the required purposes in districts where a sufficient quantity of Government land is not available, how far the landholders themselves or local boards will be able to co-operate with the Government in the matter, and at what cost suitable areas can be procured.

11. The Agricultural Department will probably at present be most usefully employed in ascertaining, by actual experiment, and in consultation with the Forest Department, what are the best means of bringing waste lands into a condition in which they can most economically provide a supply of fodder in a year of drought, and in what way they can in ordinary years be most profitably employed. The Department would also superintend, in correspondence with Commissioners, the analysis required by the preceding paragraph, and would review for the local Governments the reports received from each division. The same department may also ascertain whether any system of stacking hay or storing fodder can be established, or whether it may not be useful to close grazing reserves for a portion of the year, especially when other fodder, such as the stubble of newly-reaped crops, is available. For if grass reserves are only thrown open when no other food is available, the grass will have the requisite opportunity to make head, and will thus provide a much more ample supply of fodder than if exposed continually to desultory grazing. Enquiries of this kind will fall within the scope of the Agricultural Department.

12. This Resolution is not the place in which the treatment of land required for conversion into fuel and fodder reserves can be considered in any detail. But the opportunity may be taken to give expression to the opinion of the Government of India that little real good can be effected unless the reserves are, at any rate for some years, brought under the control of Government, and systematically protected against the invasion of goats, cattle, and fire. It appears to be a matter susceptible of proof that a protected

area will, besides giving security in a year of drought, afford over a certain number of years a considerably larger amount of fodder than an unprotected area of equal extent. It seems probable that the difference is sufficiently great to admit of a hope that fuel and fodder reserves can, in a large number of instances, be made financially successful. The importance of this view deserves some further examination of the question. The following illustrations may therefore be adduced in support of the view which has now been brought forward. In his Administration Report for 1879-80, the Inspector-General of Forests shows in the following words the results of protecting grazing land :

"In all except the most arid tracts, or where denudation has been complete and of long standing, mere protection, aided by sowing and planting in suitable places, has the effect of gradually clothing the ground with trees and shrubs. What happens is this,—the old stumps and roots in the ground produce shoots ; seeds which have been lying in the soil, and seeds brought by the wind, germinate ; the shoots and seedlings, which without protection would have been destroyed by the fire or eaten by the cattle, grow up ; and wherever there are sufficient remains of the old forest growth in the ground, the result is most remarkable. The difficulty consists in this—that new reserves must be formed, and that, during the first few years, this unavoidably entails some restrictions in the matter of grazing. At first the protection of the areas selected must be absolute, and the people in the vicinity can neither be permitted to burn the grass, nor graze their cattle in these areas. But the grass which grows up abundantly can be cut, and thus furnishes abundant cattle fodder until the forest is sufficiently advanced to admit of grazing."

13. In Ajmere the results of enclosing areas, hitherto barren, with the object of securing fodder for cattle in times of drought, are already remarkable.

"After five years' conservation there is much in these forest reserves to encourage us ; the appearance of the hills and country-side in these tracts is quite altered. The people even have begun to recognise the advantage to be obtained by the experiment we have introduced. We have been blessed with another year of plentiful rainfall ; the undergrowth has become in places in Mairwara nearly impenetrable, and in the ravines and valleys I have been surprised to see the number of fine young trees springing up. Our great enemy now is fire"—*Ajmere Forest Report*, 1879-80.

Grazing is strictly prohibited, but the villagers are allowed to cut and carry off the grass on pack animals. The cash receipts are at present small, but the benefits which the people indirectly enjoy from these reserves are very considerable.

14. Again, in the North-West Provinces, various experiments have for three years been conducted by the Agricultural Department, with the view of reclaiming *usar* or *reh* land—*i.e.*, land rendered more or less unculturable by the excess of salts in the soil. It has been found that the simple expedient of enclosure is more efficacious than any other operation. The natural grasses which, so long as the land is accessible to cattle and goats, are nibbled down as fast as the young shoots appear, spread in the enclosed areas at a rapid rate over the worst land. After two years, experimental cuttings gave a result of 20 maunds of good hay per acre—an outturn which on a square mile would suffice to feed 1,000 cattle for three months, exclusive of the bushes and trees which, there is good reason to believe, can be grown when once the grass is well established.

15. The terrible devastation caused on unprotected land by sheep, and the impossibility of re-covering forest and undergrowth once lost so long as the land is exposed to the grazing of sheep, is forcibly brought out in a late report by M. Boppe, Inspector of French Forests, on the Forests of Scotland, from which extracts are quoted in Appendix D. His remarks on the greater value of land for purposes of grazing after enclosure are, in connection which the suggestions made in paragraphs 11 to 13 of this Resolution, especially deserving of notice. The present barren condition of the greater part of the waste lands of Scotland is attributed by M. Boppe almost entirely to one animal—the sheep. There is very strong ground for believing that the goat, which may be said to take the place of the sheep in India, has been the one chief cause of the present barrenness of large tracts of country in Northern India.

Extensive areas now bare are known to have been once covered with a rich growth, if not of forest, still of scrub and grass that would, if not destroyed, have formed a rich pasturage; animals may not have been the original cause of the disappearance of the vegetation, but they have been the constant cause which prevents renewed growth. No more striking instances, indeed, of the effect of the natural recovery which ensues when goats and cattle are excluded can be found than in a comparison between those hills in Ajmere which have for four years only been enclosed, and those which have remained open to goats and cattle during the same term. The first are covered with an almost impenetrable thicket chiefly composed of shoots edible by cattle : the second are practically devoid of all vegetation, and appear to be mere heaps of rock and stone.

16. If the conclusions indicated by the facts and arguments adduced in the preceding paragraphs can be accepted, the objection which has not unfrequently been brought forward to the occupation of grazing lands on the score of the inconvenience suffered by the adjacent population in being deprived of their cattle pasture is greatly diminished. The occupation is only temporary. The inconvenience which is temporarily occasioned to the agricultural population is due to their own action in diminishing the efficiency of their grazing lands by an improper use of them. The Government proposes to do no more than restore, and, if possible, to increase, the efficiency which has been lost. The measure contemplated will, it is believed, result in a future supply of fodder, which will be far larger and far more certain than that of which the owners of the cattle have been deprived. In this view it may be even found desirable to attach for conversion into fuel and fodder reserves land which has been broken up under plough, but which, as fodder reserves, would be more profitable in preserving cattle from starvation, than in growing crops which are subject to failure in a year of drought.

SELECTIONS.

SCIENCE IN AGRICULTURE.

THERE are too many dabblers in science. In regard to the incomplete, uncertain, and intricate laws which relate to agriculture, and which go to make up what may be regarded as the science of this art, this is especially true. This is a great mischief and damage. Not that the mere study of the science of agriculture or its consideration by farmers can be in the least harmful or conducive to anything but good ; but that so many persons who never turned a furrow, or sowed a seed, or watched a plant grow from its first sprout to its maturity, and who never fed an animal, or watched its thrift and growth under the influence of feeding and management, but who have read perhaps one book upon the subject, or have attended a course at an agricultural college, will pretend to expound this most intricate science with all its profound and unfathomed depths. And thus they lead men astray who know no better than to follow their second-hand ideas, wretchedly distorted and perverse as they may be, or disgust those who are better acquainted with the subject, and are able to see the errors and blunders and misconceptions into which these "writers upon agricultural science" ignorantly fall.

There is not so much of this seen in regard to any other art than to this "art of arts." Science is the handmaid of every art. By its light and help the industries of the world are guided and led. But there is no other science in which there is so much confusion, and at the same time so much difference of positive statements and so much disputation as to principles and operations, as in that of agriculture. There are other arts of which an exact scientific knowledge is quite as desirable, such as metallurgy, the reduction of ores, dyeing, tanning, &c., but in these there are not nearly so many or so great differences of opinion as in regard to the growth of plants and the sources from which plants derive their substance. Nor is there any other subject of scientific inquiry in regard to which so many positive beliefs are so rudely and completely upset and displaced as in this. A study of the history of agricultural chemistry and physiology brings to mind the mistakes and errors of the old alchemists, the founders of the science of chemistry, as they groped in the dark, before the dawn of light fell upon them, and which were simply truths half learned, and facts only dimly seen or perhaps not seen at all, but merely recognized in part by their effects. And as the daylight dawned, and these facts were viewed in the full light, and viewed on every side, and their relations were better understood, knowledge became accurate, and demonstration took the place of opinion and belief. What a cloud of misunderstanding was swept away by the discovery by Dalton of the ultimate constitution of matter, and upon which he founded his atomic theory ; no longer a theory but a recognized law, although it is proved only by indirect and secondary evidence, and

Show is held we trust that some convenient method of displaying the samples submitted will be devised, and that on another occasion more space will be allotted to this class of produce. The other fibres made a fair show, but though we visited the Exhibition with every intention of adding to our knowledge of the subject, we were not able to learn much, and the judging did not afford us much guidance; probably the Stewards of the section were not able to tell the judges what there was competing. The judges remark that "the specimen of Manilla hemp shown was discolored and weak," but we noticed a small sample not competing, exhibited by the Saidapet Farm, which, although extracted by hand labour and at considerable cost, showed that it is possible to obtain good fibre of this kind, and that the great problem is now to extract it, in great lengths, economically. The magnificent specimens of the plant which yields this valuable fibre, mistaken by many we imagine for common plantain plants, which stood just inside the main entrance, showed that even in the climate of Madras supplies of the fibre can be raised, whilst on the West coast it grows luxuriantly and almost without any trouble. As the judges remarked, the show both of green and dry fodder was very poor, and, considering the work which has been done at Saidapet in this direction, disppointing; here, again, the rule preventing Government institutions from competing for prizes, prevented public attention from being drawn to some excellent exhibits from our Government Experimental Farm.

In the class devoted to special and plantation produce, the arrangements were better, partly because there was not so great a variety, but chiefly because one of the judges (not a steward) visited the exhibition before it was opened, and aided in arranging the articles which the overworked staff were struggling by hook or by crook to get into something like order in one-fifth of the time necessary to do it satisfactorily. Here we noted that no proper arrangements were made for testing such articles as cannot be judged by inspection, cinchona bark, for instance, and we did not at all envy the judges in their labors. Regarded as a whole, the show in this class can only be regarded as fair, and we must remark that we regard oilseeds and fibres as being just as much "special produce" as sugarcane, or indigo, and other dyes. There were some very fine specimens of sugarcane exhibited, but the finest specimen came from beyond India, and we are glad to hear that it received the first prize; its exclusion from a prize would have been most ill-advised, for we want to know where the finest produce can be grown, just as much as to encourage the growth of fine produce in India. When it is known where good seed can be obtained, it will be easy to obtain it, and distribute it to our ryots, in lieu of their own inferior sorts, and whether a bundle of sugar-cane comes from the Straits Settlements, or from Bellary, it is equally deserving of a prize. Encouragement to the introduction of good staples is just as important as encouragement of their growth, and until it is known whence good staples can be procured, introduction cannot proceed. The exhibits of forest produce were disappointing although several fair collections of woods were shown; still, here again nothing could be learnt regarding their respective costs. Tassa silk cocoons came fairly well to the front, and there were several exhibits of honey; whilst Dr. Shortt's bee-hive attracted a good deal of attention.

The division of the exhibition devoted to manufactures and miscellaneous articles drew crowds of visitors, but we question the advisability of mixing up laces and harrows, silk cloths and chillies, in the same exhibition; and in this particular case, it is very evident that the Committee were unable to cope with the difficulty of displaying these exhibits, whilst the space available was absurdly inadequate. Some of the articles included in this section no doubt properly appear in an Agricultural exhibition, *e.g.*, cumblies, reeled silk, canvas and gunny, bricks and drain pipes, and ropes, but others were much out of place; and if it is desired to hold exhibitions of the local manufactures, the work should be done separately, although perhaps it might be usefully connected with an Agricultural Exhibition. In the list of prizes for miscellaneous articles, there was nothing particularly out of place, but we fear that there was considerable repetition, and that exhibits of the same substances might be made both in this and in the class devoted to special produce. The wool shown was all coarse and inferior, but not so bad, but that a few crosses of good wool-bearing breeds would render it a valuable article for export. In the jaggery also, we notice some excellent exhibits from Salem, but here also no indication was given as to the price. We also noticed a small example of very fair-looking jaggery, made, we learn, at Saidapet, on the usual native system from the juice of the Amber sugar-cane, a variety of the Chinese, *Sorghum Saccharatum*, which should encourage any one interested in the matter to attempt the growth of this crop in the other parts of the Presidency, for, if its growth can be made successful, and good jaggery made from the juice, there is little doubt that the sugar trade of the country will be revolutionised.

And now we must cease from our pleasant duty of recording our observation on this, considering all the difficulties to be contended with, most successful Exhibition. Whilst we have been unable to do otherwise than criticise the defectiveness of the arrangements in several ways, we are quite aware that, in a practically new undertaking, under untried circumstances, and with no experience to guide them, the Committee have achieved a great deal; and we hope that when, in a few years' time, another exhibition is held, the then Committee may be as successful in getting together as good a show of the manifold productions of the country, and that the minor faults we have noticed may be conspicuous by their absence. To facilitate this, all the experience gained now by the Committee, Stewards, and Secretary, should be recorded for the guidance of those who may come after them. We hope that the present Secretary, Mr. W. R. Robertson, M.R.A.C., may have the pleasure of organising many more exhibitions for us before he vanishes from this country, the great agricultural wealth of which he has so long been striving to develope.—*Madras Mail.*

LIGNIFICATION AND ITS TECHNICAL ASPECTS.

On the 25th of January a paper was read at the Society of Art by Mr. C. F. Cross, dealing with the subject of the treatment of wood and woody fibre for the purpose of manufacture. The whole question was handled in an able and interesting manner, but the points of practical importance to paper-makers were those relating to the processes for treating wood and other resistant vegetable substances for the preparation of paper pulp, and the modifications of these, which we can show to follow from what is known of the composition of these fibrous structures. Up to within a comparatively recent period, these processes have consisted uniformly in a drastic treatment with alkaline solutions; the process of boiling under pressure with caustic soda, originally applied by Routledge to esparto, has been generally extended and adopted, and is, indeed, the standard method of treating lignified substances for paper-making; efforts to substitute this process by one based upon the principle of reduction or anti-oxidation have been made by one or two technologists, who, at the same time, do not appear to have approached the subject from the same point of view. The subject appears to have been developed most consistently by Fry and Ekman, and as their labours have had strict reference to the principles under discussion, their treatment will occupy the prior place.

Fry commenced the investigation of this subject about 17 years ago. He was familiar with Houghton's process, the object of which was to throw the work of disintegrating the wood upon the agencies other than the alkali, which latter it was found could be proportionately reduced in quantity. Fry was led to investigate the resolving action of the water alone, under the guidance, not unworthy of mention, of a passage in Faraday's "Manipulation," which directs the chemist, in analysing a mixture, to adhere to the method of preliminary separation by means of solvents successively applied, of these water being the first. It was found that water, at sufficiently high temperature and pressure (70lb. of steam), exerted a very considerable disintegrating action, sufficiently indeed to produce a pulp well adapted to the manufacture of brown paper: also that of the soluble products of resolution a large proportion were acid bodies. The following statistics, having reference to the two processes, are worth reproduction, the wood operated upon being in both cases that of the common *Pinus Sylvestris*:—

(1.) *Houghton Process.*—5,378 parts (dry) wood, yielded 1,787 parts dry pulp=33 per cent.

(2.) *Water Process.*—6,338 parts (dry) wood yielded 4,424 parts dry pulp—70 per cent.

The process of disintegrating the wood by means of water, at elevated temperatures, was worked to a practical issue, and a mill was put up at Bergvik, in Sweden, for the manufacture of "half-stuff" for brown paper. At the same time, investigations where continuously prosecuted with the view to increase the solvent action of the water, and thus to arrive at a product more nearly approaching cellulose. It became more and more evident that the condition of oxidation was especially inimical to this end, and to antagonise it by the presence of a reducing agent was the purpose which underlay the next series of experiments. These were carried out by Ekman, and his choice of a reducing agent soon fell upon sulphurous acid, a choice which was perhaps in the first instance determined by a natural fitness on the side of economy, but is now seen to have the more important function conditioned by the peculiar relationship of the sulphites to the aldehyde products of resolution of lignose. The results which followed from this modification, the removal of a further 20 per cent. of the noncellulose constituents of the wood, and the production of a residue which is but little removed from pure cellulose, are now matters of common knowledge. The special commercial advantages which this process offers, viz., the power to employ a raw material at £2·3 per ton, from which 40 to 50 per cent. of a pulp is obtainable, suitable for all classes of paper; the use of re-agents of little cost; and the production of a solution of the non-cellulose constituents, from which doubtless, valuable products are to be isolated, or which, at least, will cause no detriment to the water-courses into which it may be run, are sufficiently obvious to have already commanded considerable attention from practical men.

The Ekman process differs from the water process, in the sole particular of the presence of the magnesium sulphite; and the function of this salt appears to be, not so much to aid positively in the resolution of the wood, as to prevent the degradation of its constituents in virtue of the reducing activity of its sulphurous acid, and the property of the entire salt of forming compounds with certain of the non-cellulose constituents which enter into solution. In other words, the water, at the elevated temperature at which it is employed, appears to be the effective solvent; but while under ordinary circumstances, the solvent action reaches a limit determined by the formation (by way of oxidation and synthetical combination) of secondary derivatives, which resist the solution, these secondary changes are obviated by the presence of the sulphite and the resolving action of the water is allowed to proceed unimpeded.

Other processes for resolving wood by means of solutions of sulphites have been patented, and worked with more or less success. Upon the exclusively practical question of deciding as to the relative merits of these, it is not for us to speak. We may, however, inquire from what point of view their originators have investigated the matters, and therefore, so far as a study of their specifications will permit, to what extent they contribute to the establishment of the general principle upon which they proceed.

In 1866, Tilghman patented a process for the preparation of paper pulp from wood, by heating with sulphurous acid solution, with or without a base, and at a pressure not exceeding that of the atmosphere. In his specification he builds upon two properties of this

re-agent as especially contributing to the result, viz:—(1) Its bleaching action upon vegetable as upon animal tissues; and (2) its specific action as an acid upon the constituents of the wood. This point of view involves no general theory of the chemical function of the substances operated upon; and the want of success which attended Tilghman's work is referable partly to their somewhat inadequate conception of the theoretical basis of his process. Augustus Mitscherlich took out in 1874 a German patent for treating wood with a solution of bi-sulphite of lime, and his process has met with considerable success. This chemist, in his specification, wisely avoids theoretical matters; at the same time, from the statement which it contains that the yield of cellulose from *Pinus Sylvestris* amounts to 60 per cent. of the weight of the wood, we are enabled to gather (1) that he effects a very incomplete resolution of the wood substance, not much more, indeed, than by means of water at the same temperature as that employed by him; and (2) that he attaches a very different meaning to the term cellulose from that which is current amongst chemists who have investigated this subject from the more purely theoretical point of view. We cannot see, therefore, that either of these processes was instituted upon a clear recognition of the chemical relationship of the re-agents. The process also, which bears the name of Francke, is one which addresses itself rather to the main practical end of converting wood into paper pulp than to the establishment of a general principle, and, therefore, can only claim from us this passing notice.

Whatever be the minor issues of these several processes in their competition one with the other, they all offer a solution of the problem of preparing paper-pulp from wood under reducing conditions, and constitute, therefore, together with the many obvious points of superiority of the products, both soluble and undissolved, and of its results, economically considered, a very strong indictment of the older methods; added to which, confirmatory evidence drawn from the theoretical investigations of the constitution of lignified tissues, makes the case for the sulphite method complete.

We must not omit to notice that there has been hitherto a practical objection to this process, which has been of sufficient weight to deter many from adopting it, who were on other grounds fully satisfied as to its superiority—this lay in the necessity of using a lead-lined jacketted boiler, a very costly piece of apparatus in the first instance, and one very liable in the next place to get out of order by displacement of the lining, and thus to cause serious interruptions. It has only recently become known to those engaged in developing this process that a metal has been in use now for several years, in the process of manufacturing glucose, which resists the action of dilute sulphuric acid boiling under pressure, and fulfils all the conditions demanded by the sulphite process for wood-pulp. Its adoption removes the only serious objection which could be urged against the many advantages which it offers.

In the ensuing discussion, the Chairman said Mr. Cross entitled his paper "Technical Aspects of Lignification," but it was mainly directed to the set of changes which occurred in "delignification." The point mainly to be discussed was the success of the various processes to which he had referred for converting such a very common and cheap material as ordinary wood into paper. The chief questions of interest were the character of the fibre produced by the various processes, the yield, the cost, and the use made of the sulphites to which the author had alluded. Although, no doubt, sulphites generally would exercise a protecting action chemists knew that often very minute differences, such as would exist between the various sulphites, might be of most material importance in cases of this kind.

Mr. George Fry said there was one point to which Mr. Cross had not referred, on which he might say a word. He wanted to satisfy himself some years ago that the chlorine process was actually a process of oxidation; he therefore made the following experiment. He treated wood with water at high pressure, and after washing the fibre thoroughly, obtained the brown pulp shown on the table; he then took this pulp and treated it with a dilute solution of nitric acid, and warmed it gently; he thus got an oxidation of the brown colouring matter by the decomposition of the nitric acid. He then treated the pulp with an alkali, and washed away that part of the encrusting matter which was soluble, and by repeating the process several times, got at last a cellulose which was virtually pure but not white; it was a grey colour: under the microscope it appeared colourless; and in order to produce the white colour shown in the other specimen it had to be treated with chlorine. That was an interesting experiment, as showing clearly that the solubility of the encrusting matter was purely due to oxidation. As to the yield of pulp by the different processes, Mr. Cross had told them that if wood were boiled with a caustic alkali, at high pressure, you got, in the main, a yield of 33 per cent. He was interested to see the result if he first boiled the wood in water at high pressure and afterwards treated at the high pressure with caustic alkali; he should have obtained the same quantity of cellulose which he would have obtained if he had treated the wood direct with the caustic alkali, but he found to his surprise that the yield obtained was considerably less, being not more than 25 or 26 per cent. By the present process, however, they obtained a yield of something like 48 to 50 per cent. He was, therefore, of opinion that in both the alkali process, and in the process of first boiling with water, and then treatment with alkali, there was a solution of the cellulose in some way or other.

The following letter on the subject of Mr. Cross's lecture on "Lignification," appears in the *Society of Arts Journal* for the 9th February:—

"I regret much that I was unable to be present at Mr. Cross's lecture, the report of which I have read with great interest, as the subject discussed will, without doubt, have a most important influence on the future of our paper trade. Mr. Cross referred to me as originating the process of boiling under pressure with caustic soda, as applied to esparto; this is not correct, as none of my several patents specify high pressure, but the contrary; neither have I employed high pressure since the introduction of esparto to the trade in 1861, up to the present time, during which I have been treating from 120 to 160 tons of esparto weekly. Indeed, I do not consider that high pressure is required for the treatment of esparto or fibrous materials of a similar character; and although I am aware that high pressure is employed by some paper-makers, its advantages are very questionable; certainly as good results are obtainable by low or atmospheric pressure. The case is different with wood and other vegetable substances of several years' growth, which demand more energetic solvents, and more elevated temperature, only obtainable by high pressure. Mr. Cross referred to Tilghman's patent of 1866, as heating with sulphurous acid solution with or without a base, and at a pressure *not exceeding that of the atmosphere.* This is not quite correct, as, in the specification of that patent now before me, Tilghman claims "treating vegetable substances, which contain fibres, with a solution of sulphurous acid in water either with or without the addition of sulphites, heated in a close vessel under pressure," &c., and in the body of his patent, he specifies boiling in a closed vessel, heated by means of a steam-jacket, until the temperature of the liquid (sulphurous acid and sulphite of lime) is about 250° Fahr. (=35lb pressure.) In 1876, Tilghman took out another patent, claiming the use of sulphurous acid in water under pressure not exceeding that of the atmosphere, stating that the addition of sulphite of lime, magnesia, or soda, or other suitable base, so as to form an acid bi-sulphite, is advantageous. Both these patents of Tilghman's have expired, but a Frenchman, M. Lioud, took out a patent in 1877, for the treatment of woody and textile fibrous materials, with solutions of sulphurous acid, either alone, or more or less combined with different bases, and at a temperature more or less elevated and prolonged. This patent, however, was allowed to lapse, assumedly finding he had been anticipated by Tilghman. Now we have Mitscherlich's patent, 1874; Francke's, October 1881; Ekman's, Nov. 1881—all claiming similar processes to the above, and we have, it would appear, to choose between these acid and the caustic soda processes, the latter patented by Houghton in 1857. We have excellent pulp made from wood by the caustic soda process, and it remains to be proved whether that produced by the acid process is equally good, and can be as readily produced with no drawbacks or disadvantages. Wood pulp will certainly extend in use as a paper-making material, seeing that esparto, on which we now mainly rely, maintains its price, and is likely to become dearer.

"THOS. ROUTLEDGE

"Claxheugh, Sunderland, Feb. 6, 1883."

NEW PRODUCTS IN THE LOW COUNTRY OF CEYLON.

GENERAL REPORT FOR JANUARY, 1883.

Liberian Coffee—Cocoa—Nutmegs—Cloves—Rubber—Teak—Gamboge—Fruit—Sago—Pepper—Tea.

THIS has been on the whole a dry month, though a few showers fell at intervals of ten days. About the middle of the month, the strong land-wind ceased, and it has since been calm and occasionally cloudy.

The variety of coffee that suffered most from the *H. V.* is throwing out many suckers from the stem, but nothing on the bare branches, while every leaf, as it expands, becomes the prey of the pest. Such trees as have been only partially denuded of leaves are throwing out secondaries, but with the same result—every fresh leaf becomes infected. Such as came out of the epidemic with little damage have taken a fresh start of regular growth, and promise well, if they can only weather the next storm of spores. The largest blossom of the season was out on the 22nd, and has all set. Of course there was none on the entirely denuded trees, but on the partially denuded it was full, and on the least scathed very large: that is to say, there is as much crop as can be packed on the tree.

The cocoa is recovering from the effect of the wind, but many of the trees still look bare and ragged. When the tree, however, has weathered through the first two years, it seems to have acquired a fund of vitality that rapidly repairs any damage sustained from the weather, unless the soil is too poor, or the situation too bleak, to permit them to get into form at all. Even in such situations, if they survive the first eighteen months, they do not die outright, but continue struggling, and sending up fresh stems, as the old ones wither, till a spell of favourable weather enables them to branch, and then it is safe to become a tree. As soon as the stem is surmounted by a crown of branches a foot long, it comes on with a rush, adding six inches to the length of the branches at every monthly flush, till checked by unfavourable weather. I have three-year-old trees here that completely shade a circle twelve feet in diameter, and, in one case, the first crop is seventy well-established pods, and so little does the tree feel its work that suckers have to be stripped from the stem almost weekly. There are fresh trees coming into bearing week by week, and, as I said last month, there will be an appreciable crop twelve months hence, I begin to believe in this product. In a carefully selected soil, and exposure, we may safely calculate on five hundredweight per acre, on the average of years. This, at 80s., gives 400s.=Rs. 240. The most liberal cultivation and all other expenses of bringing to market would be amply provided for by Rs. 120, leaving Rs. 120 as the profit for the proprietor. After encountering the enemies of the plant, termites, crickets, a species of caterpillar, and a minute insect that preys on the young leaves and tender bark, we have now to make the acquaintance of the foes of the fruit. So far I have only met

with two. One day, I found five ripe pods on one tree and two on another, with the husks torn open, and the seed abstracted. At first I thought it had been a thief, of the genus *homo*, variety Sinhalese, but on reflection I came to the conclusion that a human thief would not have sought the least accessible spot in the property, when he could serve his purpose equally on easier ground. Moreover he would not have torn the husk open, with his teeth, or nails, leaving the empty shell on the tree, when he could have carried it off bodily, with so much less trouble. Finding this solution untenable, I had to choose among flying-foxes, squirrels, and crows, and I have not yet settled the point, but a couple of squirrels were seen disporting themselves among the rocks suspiciously near the scene of plunder. The other enemy is a small worm that eats through the husk and enclosed seed before it is quite ripe. I have only found one pod so perforated, but that was utterly ruined.

Since the dry weather came, the few cardamom plants I have took a start, and are now growing rapidly. It seems after all to be that rain was the retarding element.

A nursery of 800 nutmegs produced 240 plants, one-half of which are probably males, and can only be eliminated, after flowering, at the end of four or five years. I am however encouraged to extend this cultivation from the large crop this tree yields after the fifth year, and the promising condition of a few plants on another place.

I have a few clove plants down, but in this dry weather the growth is very slow, but most of them look healthy.

The rubber trees are taking a rest during this dry season. I had a good crop of seed, but when I set about collecting it off the ground, I found that some one had been there before me. I have made enquiry, but have found no *clue*. I had no suspicion that any one would touch it, but after the deed was discovered I recollected that Rs. 10 per thousand is still demanded in some quarters, and, perhaps paid. So I ceased to wonder why Sinhalese villagers or estate coolies should desire to possess it.

I have land ready for a pinery, and only wait for a few showers to get plants of the best kinds. At the tropical garden, a Kew pine of 19 lb. has been achieved on indifferent soil, and from the very superior appearance of the few plants of this kind I possess, I expect still better results. Of all the fibre plants with which I am acquainted, that of the Kew pine is the finest and the strongest —far too valuable for paper stuff, but especially suitable for the manufacture of thread or linen of the finest quality. In any mechanical process of extracting the fibre from the fresh leaf, the waste would be enormous, but, if Ekman's process can be applied on a smaller and less costly scale than that needed for a large paper mill, a vast trade could be created under the auspices of a local limited company in a couple of years. The quantity of fibre-yielding material in any circle of ten miles radius that goes to waste in the low country of Ceylon would keep a factory at work without any special planting for the purpose. The promoting of a company is not in my line, but I bestow the idea on the public gratis, and I hope it will be taken up by some one, with the necessary qualifications of personal influence and business habits.

Of timber trees, teak grow freely for the first two years, but it is growing little or none now. Certain insects so utterly destroy the leaf, that many of the trees are mere bare poles. In rapid growth the teak beats every other tree. In fresh land of fair quality and not on a severe exposure, it makes one foot in height every month, till it reaches about ten, when it begins to spread out, and the rate of ascent diminishes. I think halmilila is a valuable timber and a good shade tree. On the land now clearing there is much milila, mostly of no great age. I am trying to save all the straightest stems for shade.

Can you tell me if the gum of the goraka tree is the true gamboge and what the value of gamboge is in the market? I will send a sample for report as soon as I can collect enough.

Of fruit trees, the most flourishing I have here is the rambutan. Some thirty plants put in the field are growing very vigorously. The nam-nam plants have all perished but two, and they are not promising. Of some hundreds of oranges I planted, about twenty have outstripped the destructive agencies to which the young plants are so subject. Many other native fruits that I have sooner or later failed from a variety of causes, the chief of which are insects and wind. It looks as if the bread-fruit would do well here, in sheltered spots, judging from the one plant that has already become a tree.

The sago palm seed has not germinated well. Indeed very few have grown beyond those that were germinated in the box when they arrived. I will possibly have 100 plants, but I do not know what to do with them, as I have not an inch of the sort of land they are said to require.

After Mr. Holloway's warning about pepper vines I must ascertain whether I have got the best kind. So far as my eye can judge, I can see no difference between what I can get in a neighbouring village for the trouble of removal, and that bearing a high price at the tropical garden, but I must bring the specimens together before extending the cultivation.

The only tea field yet established in this district is on Commilla estate, two miles from here, the property of Dr. Stork, and managed by Mr. A. J. Stork, who has had some years of tea-planting up-country. The field was planted last May, and I can hardly realize a more rapid growth than has taken place, my opinion being just worth as much as that of any other man who has no experience whatever. I believe this is the northern limit of tea cultivation in the low country proper, but it will probably creep northward, as far as the Mahaoya, beyond which lies the region of protracted droughts, which seems the one condition likely to check its profitable production. It seems to thrive on all soils and in all temperatures: from sea-level up to the slopes of Pidurutalagala, while the art of manufacturing the leaf is daily extending and improving. Tea seems destined to be a far greater king than ever coffee has been, and with cheap labour, perfect machinery and ever-increasing skill, Ceylon will be able to hold her own with all the world. As long as the heathen Chinee can poison Christendom with his spurious abomination there will be room in the markets for the genuine article, and the Ceylon planters have always produced the best of whatever they cultivated, and will no doubt continue to do so on a more extended list of products. Ceylon cocoa has already topped the market, Ceylon holds its own with India and Java in cinchona, Ceylon tea is asserting itself, and a multitude of minor products will help to keep the pot boiling. *Hemleia vastatrix* has been a sad enemy to the planting interest, but it has not been all evil. Had coffee encountered no more pronounced enemy than the failing fertility of soil, the losing battle would have been fought for a long series of years to come without calling out the reserves and auxiliaries, and the cinchona, tea, cocoa, cardamoms, rubber, &c., would not have been in existence as exported products for many a long year to come. The coffee-leaf fungus is the immediate parent of all the new products that Ceylon is now sending forth, and the planting mind being roused and its energies directed into this channel, there is no discernible limit to the amount and variety of Ceylon's products. Other tropical lands have superior soil, but Ceylon rests her capacity of competition on three facts—a forcing climate, cheap labour, and superior skill.

CINCHONA.

Report of the Sub-Committee of the Planters' Association appointed to communicate with Government on the subject of a series of analyses of Cinchona Barks, in order to obtain reliable data for the guidance of Cinchona Growers.

YOUR Sub-Committee begs to submit its report at the conclusion of its labours, which it regrets have not been successful in achieving the result desired.

It will be in the recollection of members that the following resolution was unanimously passed at a recent General Meeting of the Association, *viz.*—That this Association, in view of the large and increasing cultivation of cinchona in Ceylon, respectfully requests Government to have a series of analyses of barks made in order to obtain reliable data for the guidance of cinchona growers, and that a Sub-Committee, consisting of Messrs. A. T. Karslake, T. C. Owen, G. A. Talbot, Wm. Forbes Laurie, and W. Smith, be appointed to communicate with Government." Your Secretary immediately forwarded a copy of this resolution to Government, and expressed the hope that it would receive early favourable consideration. No answer having been received to this communication, and it was thought that Government might be waiting for some definite scheme to be laid before it, it was deemed desirable to ask if Government was prepared to accede to the request made, and if so, if it would instruct the Director of the Botanic Gardens to place himself in communication with the Association. In answer, it was intimated that the Governor does not consider that the Government can undertake the work of analysing cinchona bark, and a copy of a despatch from the Secretary of State was forwarded enclosing correspondence with Messrs. Christy & Co., London, complaining of the action of the Commissioners on New Products, and stating that Lord Kimberley has given a distinct assurance that it is not intended to interfere with the ordinary course of trade, and adding that be had no doubt the views expressed were shared by his Excellency. Your Sub-Committee having duly considered the reply received and connected correspondence felt that, however advisable, on general grounds, the decision arrived at in connection with Messrs. Christy & Co.'s complaint might be, it had no necessary practical bearing on the Association's request that Government should arrange for a series of analyses of cinchona bark in order to obtain reliable data for the guidance of cinchona growers. On the contrary, your Sub-Committee maintains that it appeared to militate in no way with the principle laid down by the Secretary of State.

In support of this view, the following reasons were submitted for the consideration of his Excellency the Governor:—

I. That if the Government decides to procure the series of analyses asked for, these analyses will doubtless be made by eminent analytical chemists in the way of their profession, and accordingly that private enterprise will be encouraged rather than otherwise.

II. That when the data desiderated have been obtained by means of analyses, the ordinary operations of commerce will certainly be stimulated. It was further pointed out that your Sub-Commitee hoped to be guided by the valuable assistance of Dr. Trimen in the classification of the samples, with a view to enable the Government to lay them before Dr. Paul or some other eminent chemist, and as a further argument for a reconsideration of the subject by his Excellency, the course pursued by the Indian

Government was instanced, and also the present need for every encouragement and help in the prosecution of the enterprise in Ceylon. Your Sub-Committee regrets that on a re-consideration of the question, his Excellency the Governor was unable to reverse his previous decision, and accordingly that for the present at least it must be reluctantly accepted that the Government does not desire to be in any way instrumental in furthering the development of the cinchona planting enterprise in Ceylon on a scientific basis by rendering the assistance asked for, or by affording special help and encouragement to planters in endeavouring to ascertain authoritatively the varieties most likely to be successfully cultivated in various districts, altitudes, and soils.

COFFEE.

COFFEE PROSPECTS.

A CORRESPONDENT of a contemporary writes :—

A review of the present state of the coffee trade would show that it is suffering acutely from the action due to speculation and over-production. Prices have fallen away to the lowest limit compatible with its profitable cultivation. Indeed, there is reason to believe that at 65 shillings per cwt, the price at which M. P. coffee stood a few weeks ago, only the largest, and the best managed, unencumbered estates can work at a profit. Some few years ago large fortunes were made in coffee, in Ceylon, Java, and South America. The public came to know it, and at once there was a rush for the coffee countries. Fancy prices were given for land, extensive plantations were opened, and after a time production was enormously increased. But still, somehow, the demand for coffee kept pace with the supply, trade was good, money was plentiful, the habit of drinking coffee spread, and the price steadily rose. Then speculation ensued ; merchants bought coffee for the rise ; bankers and houses of agency put their money freely into the hands of planters on the security of land or crops, and a very strong coffee "interest" was established. At the beginning of 1877 coffee prospects were at their brightest, apparently ; M. P. coffee touched 121 shillings a cwt.—the high water mark of the coffee rise—double the figure it stood at a short time ago. Ever since, with the exception of a slight rally in January 1880, there has been a continuous fall. The break-down of an American coffee ring, which locked up large supplies in the expectation of a further rise, is said to have had much to do with the fall. Be that as it may, the markets of the world were at length overstocked, a period of general commercial depression followed upon the period of prosperity, in which coffee has shared, money became scarce, speculation in coffee came to a stand-still, and prices fell. With falling prices there came the borer and leaf disease to embarrass the astonished planters ; leaf-disease, the chief enemy, existed long before, but had been kept at bay by high and expensive cultivation. Now, diminished crops and falling prices re-acted injuriously upon plantations, and leaf disease spread alarmingly. No need to describe the battle with leaf disease. It ended badly. For the most part bravely struggling with adversity, planters without sufficient capital of their own, on bad soils, or otherwise cramped, sank deeper and deeper in—their agents' books. At last the day of reckoning came ; in many cases too long delayed. Then it was found that capitalists had been throwing good money after bad, and in the hope of averting bad debts of comparatively small amount, had incurred serious losses. Not only houses of agency, as they are called, but old and solid banks felt the pinch, and hundreds of shareholders, innocent of all knowledge of coffee, felt it in diminished dividends and sunken capital in their houses far away. All this was not calculated to improve the market price of coffee. Investors of all kinds gave it a wide berth, and down it tumbled from bad to worse in spite of the full demand which subsequently arose. It was not leaf disease which cast down the market price of coffee ; although that statement is often made. The more leaf disease there is, the scarcer and dearer coffee must become. But indirectly it confirmed the fall by ruining the planter, who, in his turn, crippled the capitalist, who consequently avoids coffee speculation, and will do so until it pays. As will be seen, coffee depression has touched the lowest point The injurious influences which affected it are temporary in their nature and are passing away ; and most important of all, there is no diminution in the consumption of coffee, but rather the reverse.

FORESTRY.

THE FORMATION OF CONCENTRIC RINGS IN WOOD.

UNTIL very recently it was a matter of doctrine to believe that the concentric rings one finds in most woods* constitute each one year's growth. To have questioned the universal truth of this dogma would have been considered the most rank heresy. Even at the present day many writers on forestry fondly cling to the old belief, and this blind uncompromising adherence in every case, in spite of the clearest evidence of contrary facts, to an untenable and exploded theory detracts very considerably from the value of a recently published book, the *Manual of Indian Timbers*, which has obviously cost the writer a vast amount of labour, and is in many respects full of very useful and trustworthy information, both original and compiled.

Recently the *Timber Trades Journal*, in its issue of 11th November last, quoted an interesting extract from the *Canada Lumberman*, giving an authentic instance of the formation of more concentric rings than the number of years in which they were produced. In 1859, a M. Charnay caused all the trees to be felled, which hid the façade of one of the pyramids of a palace among the ruins of Palenque in Mexico. In 1880 he again visited the place and cleared the trees that had grown up during the interval of 21 years since 1859, and noticed that of all them contained more concentric rings than their age included years. On the section of one tree, about 2 feet in diameter, he counted 250 rings. "A shrub, 18 months old at most, had 18 concentric circles !"

The extract then goes on to say that Professor Bachelart has asked whether "M. Charnay took account of certain coloured rings which some tropical trees present in cross-section, and which are to be distinguished from the annual circles." These lines of different colour, as every one knows, mark the progressive conversion of the sap-wood or alburnum into heart-wood or duramen, and may be seen conspicuously illustrated in many Indian woods, such as, for instance, teak, *Boswellia thurifera*, &c. They have nothing to do with the production of new wood.

The *Timber Trades Journal* then remarks as follows :—

"If this be so—and it must be observed we have only one witness yet—the learned in arboriculture, ancient and modern, have been at least doubtful, if not false, teachers. And if this deviation from the old rule is peculiar to 'hot and moist climates,' where shall we draw the line ? There must be some intermediate stage of average barometrical temperature (*sic*) at which this perplexing change commences in the development of tree growth, or is the whole hypothesis imaginary, and no rule at all ?

"This important question cannot be allowed to remain in its present unsatisfactory state. The account given by M. Charnay, as recorded by Professor Bacholart, will have to be either contradicted or confirmed ; and a very pretty controversy among adepts, or, as it is now the fashion to call them, experts, is likely to result from it. It seems almost impossible that two theories so opposite to each other can both be true : and, if there be found a connecting link between them, how shall we know to which side of it our specimen may belong ? Hitherto these 'concentric circles' in trees were as religiously believed in as the revolutions of the planets. Are we now to unlearn all we have been taught about them ?"

As the subject of the above remarks is extremely important, and, as the remarks themselves show, but little understood, I may be pardoned if I venture to contribute towards a better knowledge of it by publishing in the *Indian Forester*, in a condensed form, what information I possess bearing on it. For the sake of clearness, it will be impossible for me to avoid entering into some questions of vegetable physiology.

It is now an established fact that the well-defined line between two adjacent rings of wood is caused by a sudden variation of tension in the growing or other soft tissues along the circumference of the stem.

In the case of *growing* tissues, tension may be due to one or more of the following four immediate causes :—

I. Turgidity of the component cells due to the hydrostatic pressure of their contents of their walls. This pressure can occur only

* I need hardly say that the stems of tree *Liliaceæ*, of many climbers, such as *Bauhinia Vahlii*, *Millettia auriculata*, &c., and of some other monocotyledonous species do not increase by the addition of continuous layers of wood all along the circumference. An extraordinary mode of growth, which has never been observed before, and which will astonish vegetable physiologists, has been noticed by me in a specimen of *Dalbergia paniculata*, and will shortly be described in the *Indian Forester*.

is generally poor. A few of the best fruits should, therefore, be annually reserved for seed, for sowing in the following season.

KUKREE (*Cucumis utilissimus*).—This species of cucumber has fruits from one to two feet long. When in a young state they are covered with soft, downy hairs, and are then of a pale green colour. When fully ripe the colour changes to a brilliant orange. It is a true hot-season vegetable, and will not succeed in the North-West Provinces, at least during any other season. It should be sown in the end of February and any time during March. It prefers a dry, loose, open soil. A well drained plot should therefore be selected for growing it. After manuring, the ground should be laid out in beds, and three or four seeds sown in patches three feet apart. As with vegetable marrows, only one of the strongest should be allowed to remain if they all germinate. Water should be given once in ten days. If given too often the fruits turn yellow and fall off before they are ready for use. February sowings are ready for use towards the end of April. If a second sowing is made about the middle of March, it will keep up the supply until the beginning of the rains.

KHEERA, (*Cucumis sativus, var.*).—This is a variety of the common cucumber, with small egg-shaped fruit, and is also a true hot-season vegetable. In order to keep up the supply until the beginning of the rains, three sowings should be made—one in the end of February, one in the middle, and one in the end of March. It will succeed fairly well in any soil, but prefers a rich one. The ground should be laid out in drills, one foot apart. Sow the seeds along both sides of the drill, and if the soil is very dry, water immediately after sowing. After they germinate, water every ten days. This vegetable, like the *kukree*, should not be watered too often.

KURRAILA (*Momordica charantia, var.*).—There are two varieties of this vegetable. The natives call one *kurraila* and the other *kurrali*. The former comes into use during the hot season, and the latter during the rains. The greatest difference between them appears to be the season when ready for use, as both are of the same appearance. The fruit is pointed at both ends, and covered with knotty protuberances. It has a very bitter taste : nevertheless, it is much relished by some in curries. It should be sown in the end of February and all through March, in rich soil. The ground should be laid out in beds, and the seeds sown in lines two feet apart, and the same distance allowed between each seed. Water should be given twice a week until the ground is covered, afterwards once a week will be sufficient. The first sowing will come into use about the middle of April, and successive sowings made in March will keep up the supply until the beginning of the rains.

BRINJAL OR EGG-PLANT (*Solanum melongena*).—This is a popular vegetable with native gardeners, and one of the most useful. It is almost needless for me to describe its cultivation in detail, as they seldom fail to grow it to perfection. It can be brought into season at any time, and this quality causes it to be very valuable when other vegetables are scarce. It should be sown in October and November when required for use during the hot season. It can also be sown in February and March, and will then come into use about the beginning of the rains. It will grow in any soil, but as with other vegetables, thrives best in a rich one. It should be sown in beds and transplanted when two or three inches high, in lines at a distance of 18 inches apart. It should be watered twice a week, and the soil frequently stirred around the neck of the plants. The fruits are very palatable when properly cooked, and no garden should be without them.—W. G

HOW TO APPLY FERTILIZERS.

MANY orchardists in California are, it seems, awakening to the necessity of maintaining the fertility of their orchards by the application of manures of different kinds, and it will be timely to introduce some facts concerning the method of application. There is a right way and a wrong way, and fortunately the proper method can be shown by a series of systematic experiments. A writer for the *Country Gentleman* gives the following :—"A rule adopted by an old writer gives the length of the roots as equal to the branches above. It is safe to say that this rule does not indicate generally more than a tenth of the ground which the entire roots really occupy. Many years ago I made an experiment on a row of peach trees planted in grass and within a few feet of each other. They had been set three or four years, and were eight or nine feet high. Within a few feet of one end of the row the ground was made very rich with a heap of manure. Its stimulating effect upon the nearest tree was such that the shoots made in one season were two feet and-a-half long. The tree, which stood seven feet from the manured ground, made shoots fifteen inches long, and at eleven feet distance the shoots grew seven or eight inches. At fifteen feet no perceptible effect of the manure was visible, the growth not exceeding three inches. The experiment showed that a decided benefit was gained to the tree at eleven feet distance through the few roots on one side, and that the roots formed a radiating circle at least twenty-two feet in diameter.

MINERALOGY.

THE most important result of the past season's work, says Mr. H. B. Medlicott in the February part of the *Records of the Geological Survey of India*, has been the proving of the new coal field of Umaria at the west end of the South Rewah-Gondwana basin, within 34 miles of Katni station on the East Indian Railway. This field was mentioned in the last annual report, and Mr. Hughes had given a notice of it in the *Records* for 1881 (vol. XIV, part 4) The actual area of exposed coal measures is small (about 5 square miles), in an angle between the gneissic rocks and the great spread of newer Gondwana sandstone to the north-east. The out-crop of coal had been known for many years, but its appearance at the surface was not promising, All this area had been surveyed in 1872 by Mr. Hacket, without distinguishing the true coal measures ; but, from what I had seen of the ground (in March 1869), on a preliminary inspection between Raneegunge and Jubbulpore, I was aware that further examination would be necessary before anything could be published. Mr. Hughes's success was then no chance find ; he recognised a difference between the Umaria sandstone and that of the adjoining area, and he had a close search made for fossils, from the evidence of which there was no longer any doubt of these rocks being on the horizon of the regular coal measures. He then at once marked sites for trial borings ; and these were carried out with very commendable expedition by the local authorities. The results, as to the extent, thickness, and quality of the coal, are very promising. A notice of these borings was given by Mr. Hughes in the *Records* for August last. Railway surveys are now being made for a line from Katni to the coal-field.

The field thus opened to enterprise is very extensive. Umaria is the nearest possible source of coal for the North-Western Provinces ; and immediately east of it lies the immense coal-field of Sohagpore, which district is also rich in agricultural produce and the natural entrepot for the surrounding forest tracts. From Sohagpore southwards lies the least difficult line of communication between Northern and Southern India, into the plains of Chutteesgurh, leading down the Mahanuddy valley to Cuttack, and up it over the plateau of Bastar to Vizagapatam.

Not the least important result of this new opening is the opportunity it gives for successful iron manufacture. I know of no spot in India where there is such an abundant supply of a variety of first-class iron ores as in the neighbourhood of Katni. Much of the lime now used in Calcutta comes from Katni, and other requisites will probably be forthcoming, if the coal fulfils our expectations.

Mr. Hughes extended his survey of the Sohagpore coal-field eastwards into Sirgujah. He reports in very encouraging terms of the services rendered by sub-assistant Hera Lal.

In the Annual Report for 1877 (Rec. XI, page 7), a notice was given of the explorations for coal in the Satpurah region, carried on by the Central Provinces Government under my advice, and the concluding operations of those trials are given at page 97 of the *Records* for 1879 (vol. XII). Most of those trials were near the northern edge of the basin close to the Nerbudda valley, and four of them were in interior valleys. In every case the object was to find the coal measures themselves, for the borings all started in rocks known to be of later formation, and in one case only, that close to Mahpani, was there an outcrop of the coal measures anywhere near. None of them were successful ; and it was then pointed out that the nearest ground where there was a direct prospect of coal was in the Shahpore field on the south side of the basin. The outcrops there had been reported on separately by three officers of the Survey (in 1859, 1866, and 1875), but none held out any promise of valuable seams. The latest of these surveys was by me (published with a map in vol. VIII of the *Records*), and I then marked three sites for borings in different parts of the field, in view of future experimental exploration. These trials were taken up in February 1881, by the Public Works Department of the Central Provinces, and the last of them was closed on the 11th of October 1882 under my instructions. Two of them were made to a depth of 400 feet, and the third to 530 feet. They all passed through several coaly seams,

with some thin bands of coal ; but none were of sufficient promise to recommend the sinking of a trial shaft. I believe that all the coal-bearing measures were passed through in each boring, but the seams are even poorer than at their outcrops. The coal prospects in the Satpurah basin are thus for the present reduced (besides the Mahpani mines) to the Pench valley field, of which Mr. Blanford gave a very encouraging report in 1866 (*Records*, vol. XV, part 2, 1882). This field has naturally been left to the last on account of its comparative inaccessibility ; but the engineering difficulties to be overcome are nothing like so great as those on the new Indore and Bhopal State Railways, and a line from Itarsi up the Tawa valley to the Pench would be in every respect the most favourable for crossing the Satpurah range between the Nerbudda valley and Nagpore. Such a line would pass along the Shahpore coal field, and might lead to a further exploration of those measures.

The cretaceous coal-field of Darangiri in the Garo Hills, reported on by Mr. LaTouche (*Records*, Vol. XV, part 3) during last season, proved quite as good as was expected ; the quantity is very considerable and the quality very serviceable ; but if the company now engaged in opening out the coal-fields of Upper Assam achieves anything like the service it proposes, it would scarcely pay to work the much inferior coal of Darangiri. Mr. LaTouche is now engaged in tracing the coal of the Jaintia hills eastwards, with reference to a project for a railway through North Cachar.

Mr. Foote was engaged in the districts of Madura and Tinnevelly, principally in completing his map of the coastal region, and joining this work with that of Mr. King in Travancore. The principal features of the ground had been examined in previous seasons, so there is nothing particular to be noticed. A detailed account of this large area will be published during the current year. Late in the season Mr. Foote made a traverse across part of the Mysore gold-fields, an account of which is published in the *Records* for November.

SERICULTURE.

MAJOR COUSSMAKER has concluded his experiments in tusser sericulture, and the result arrived at is a contemporary says, not such as to encourage the hope that it can be made a paying industry in the Bombay Presidency. The direction in which Major Coussmaker's efforts were chiefly directed was towards the production of "tusser waste," which term signifies the silk taken from the burst cocoons after the moths have flown. He found the expense, either of collecting the cocoons from the forests or of rearing them in a state of semi-domestication, to be so great that no margin of profit is left upon their sale to the manufacturers in England. The cocoons cannot be collected from the forest, it appears, at a less cost than four annas per hundred ; and as regards the attempts at cultivation, though the results were most satisfactory as to the quantity produced, the outlay required for watering the shrubs, protecting the worms and cocoons from crows, sparrows, squirrels, rats, &c., was again too high to admit of any profit. The tusser cocoons of the Bombay Presidency are smaller and contain less silk than those found in other parts of India, and all Major Coussmaker's efforts to increase their size proved abortive, the climate, he finally concludes, being an unsurmountable obstacle. Major Coussmaker sent home 197 lbs. of cocoons which he had collected during two years, and they realised only Rs. 146 14 annas, China is now exporting wild silk so largely that the price of tusser waste in England is only 1*s.* 3*d.* per lb. During the last year of his experiments Major Coussmaker was able to collect and produce 25,031 cocoons, weighing only 57¼ lbs. and the amount expended to obtain this result was Rs. 168-13-9. Major Coussmaker has handed over his plantation of Lagerstrœmia and Ziziphus bushes, together with the bamboo screens, iron rods, &c, he used for enclosures, to the Superintendent of the Yerowda Jail, as there is land attached to the jail, in which the bushes can be planted, and the head jailor takes an interest in the experiments. Major Coussmaker adds :—"A very little expenditure in water labour will suffice to keep the plants in good health, and, as they will continue growing, will be available for any future experiments which may be made. If no other use be made of them, they can be planted as hedges in the garden, and as they bear a profusion of beautiful lilac flowers, and when kept trimmed break most luxuriantly into leaf, they will form an ornamental, as well as an useful, addition to the gardens."

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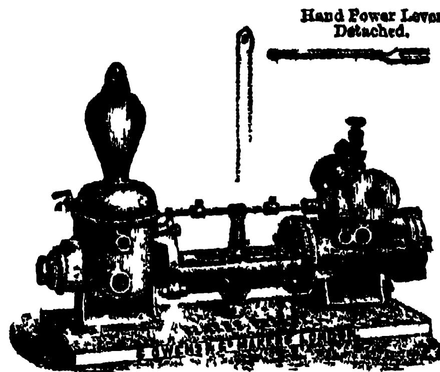
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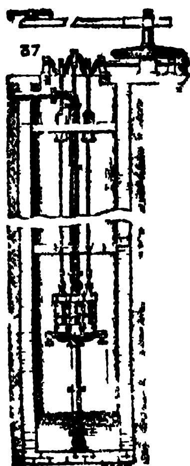
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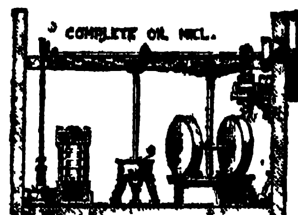
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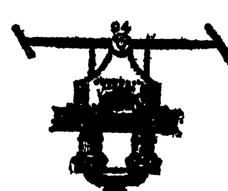
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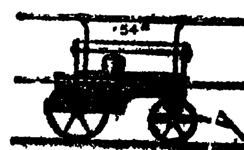
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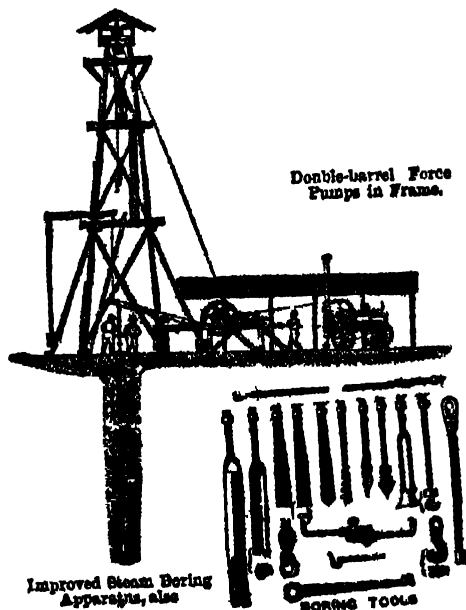
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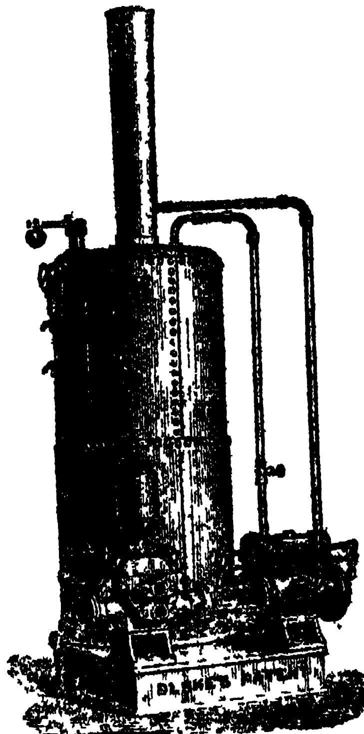
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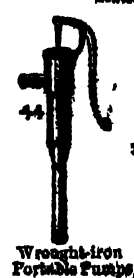


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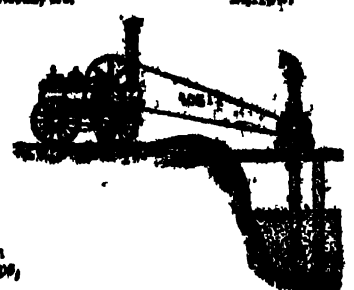
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THE INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. VIII.] CALCUTTA:—TUESDAY, MAY 1, 1883. [No. 5.

Registered No. 182.]

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VOL. VIII.] CALCUTTA :—TUESDAY, MAY 1, 1883. [No. 5.

NOTICE.

SUBSCRIBERS to the STATESMAN, FRIEND OF INDIA, *and* INDIAN AGRICULTURIST *are informed that arrangements have now been made by which these journals will for the future be published under the general superintendence of the undersigned.*

All communications concerning the general business of the STATESMAN AND FRIEND OF INDIA *Office, Advertisements, and Subscriptions to the* daily STATESMAN AND FRIEND OF INDIA, weekly FRIEND OF INDIA AND STATESMAN, *and* INDIAN AGRICULTURIST, *should be addressed to the MANAGER.*

All communications regarding literary matter should be addressed to the EDITOR *of the paper for which it is intended.*

WILLIAM RIACH.

June 13th, 1881.

CONTENTS :

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGMENTS.

THE Indian Forester for April.

NOTES on the Seeds of the Abrus Precatorius, by C. J. H. Warden, Bengal Medical Staff, Professor of Chemistry, Calcutta Medical College.

CORRESPONDENCE.

NOTICE.

NEW LIGHT.—Declined with thanks.

A UNIVERSITY OF THE ALLIED SCIENCES.

TO THE EDITOR.

SIR,—Hitherto no college or school, where the allied sciences are taught, has made, in connection with the universities, provision for conferring distinctions and honours to their different grades of students. To my mind this should, for progress, be made as early as practicable. New university certificates and titles, hitherto unknown and uncoined by the university members, should be coined, established, and conferred. There need be only one certificate, that of the *Licentiate of the Allied Sciences*, to be conferred on students who have finished three years' course of the School Department ; three College Department titles, *viz.*, B.A. Sc., *Bachelor of Allied Sciences*, to be conferred on students who have finished the first two years' course in the College Department ; M.A. Sc., *Master of Allied Sciences*, on finishing the next two years' college course, and D.A. Sc., *Doctor of Allied Sciences*, on finishing the last year college course :—altogether eight years' course—three years in the School Department, and five years in the College. Only students (candidates) sufficiently advanced in English literature, or literature belonging to any other language as applied to other countries where English is not the national or country's language, to be able to understand science, should be eligible for admission in the last class of the school department. If candidates have received a course in some college of general culture up to the end of the second university certificate known as *Licentiate in Arts*, they should be considered eligible for admission in the last class of the school department.

The real reason of, hitherto, no certificates and titles conferred by the universities on the students of allied sciences is the ignorance of the great importance of the science of plant-culture by the university syndicates and faculties in all parts of the world ; especially this is applicable to India. On the subject of certificates and titles herein referred to, the students of the Sydapet School of Agriculture in Madras applied to the Madras Government, which application proved futile, owing to two causes : the first is that described above, and the second is that the students (School of Agriculture) being wanting in sufficient learning to deserve university certificates and titles.

Since the course now in vogue for the tuition in the allied sciences is both meagre and defective (because no proper encouragement is in store for the students), reformation of the existing state of things assumes paramount importance. I will record my views on the subject as described under :—

The existing Colleges and Schools of *Agriculture, Forestry, Medicine*, and *Engineering*, also *Veterinary* (wherever existing),

now existing as altogether separate educational institutions, should be united and denominated the *United Colleges of the Allied Sciences*, established and located in the same place (any suitable locality) and within one spacious building or buildings, but adjoining each other, if one building be found unsuitable. The building or buildings should have apartments for school and college classes, laboratories, dissecting-rooms, hospitals and dispensaries, library, and office, with sufficient appendages for workshops, land for botanical garden, farm, orchards, &c., and quarters for professors, teachers, and resident students, also sheds and quarters for garden and farm animals and superintendents and resident gardeners. There need be no principal or principals in the united colleges, but only professors for college classes and assistant professors for the school classes. Students of all denominations, but studying one particular science, will be taught by the same professor or assistant professor, as their attainments will enable them, differing only in this—that one class of students will study to a certain extent, whereas the other class will finish the whole course of the science. For instance, students of the *Plant Culture* and *Medical* sections will study botany in the same class, but students of the former section will complete the botanical course, and students of the latter section will study this science only to that extent as is necessary for him to learn for *therapeutics* and *pharmacy*. The same might be said of chemistry, geology, veterinary, engineering, drawing, land surveying, &c., &c. The proposals I here advocate have *economy*, *efficiency*, and *absolute success* for their foundation; and since the science of plant culture is allied, other plans of tuition have been, are, and will continue to be failures, with heavy losses of money. The foregoing proposals will also, if carried out, be productive of the grandest result, in external appearances, the world ever saw in the educational line. The proposals, as applied to India, do not in any way interfere in the University examinations and conferring of certificates and titles. In these respects the present University systems remain unaltered to the very letter.

Like the *New York Times* writer, I hold scientific and technical journals are necessary adjuncts to high class education of all denominations.

O. L. BRYCE.

Bahraich, Oudh, April 10, 1883.

NOTE.—We have been compelled to considerably curtail our correspondent's letter. What we have reproduced is the gist of his proposals. We rather fear, however, that a good many things will have come to pass before a University of the Allied Sciences will be considered a pressing need for India.—ED., *I. A.*

THE UTILIZATION OF SEWAGE.

TO THE EDITOR.

SIR,—In your issue of April 2nd, appears an article on "Utilization of Sewage," in which an undated analysis by Dr. Voelcker of sewage sludge is made use of to support the writer's opinions.

Those who have read the article alluded to should read further the evidence given by Dr. Voelcker on the 28th July 1881, before the Royal Commission on Agriculture in which the following information will be found:—

Q. 57,373.—Do you think that there is any mode of utilising sewage profitably?

A.—The application of sewage is a complicated question; it is a sanitary question, and an agricultural question. The sanitary question is the one which has first to be solved, which must be solved at all expense, and frequently at a loss as regards the application of the sewage.

Q. 57,374.—Do you still adhere to the opinion which is given in the article which you wrote on the influence of chemical discoveries on the progress of agriculture in the *Royal Agricultural Society's Journal* in the year 1878 in these words: "in my judgment the most economical plan to dispose of town sewage is to carry it, if possible, bodily far enough into the open sea to destroy any chance of its being brought back again by the tide"?

A.—Yes; and in confirmation of that, I would say that it is now the very scheme which is being adopted in the lower Thames valley. They carry it all the way down to the sea now.

Q. 57,375.—Does that opinion imply that the sewage cannot under any circumstances be economically used?

A.—Yes, the expense of the application is greater than the benefit derivable from sewage.

A. D. O.

Cawnpore, April 19.

NOTE.—We thank our correspondent for his note: the information is new to us. But the analysis by Voelcker, quoted, was not intended to show what was realised for the sludge, but merely to show its agricultural value. Being aware that nothing is obtained for it at Leicester and other places, we could not attempt to prove that its application would be profitable at any given place, and therefore warned the Municipality of Calcutta not to look for profit until the public safety had been first considered. Everything being favourable, the cost of its application would not be equal in all places, consequently the benefit derivable might not in many cases cover the cost. There are instances, however, where profit has been the result, notably of land near Edinburgh, where the rental increased from £3 to £30 and £40 and over £50 per acre.—ED., *I. A.*

HORTICULTURAL SOCIETIES.

TO THE EDITOR.

SIR,—In the last issue of your paper, you publish a complaint made by the President of the Calcutta Horticultural Society regarding the difficulty of obtaining new members. The same issue contains a summary of the work done by the Madras Horticultural Society, and in that, a similar complaint is referred to. It may be the case that these societies find a difficulty in filling up their lists of members under the altered conditions under which we now live in India, but if it is so, the reason is not far to seek—the societies are not organised on a popular basis. It would be a great pity if either society were to come to grief, for they have both done good work in their day; but it is idle for the presidents to stand and wring their hands because the number of their members is falling off. The main reason why the number of members in either society is so small is, I apprehend, because the rates of subscription are fixed at a figure far too high to admit of any large number of people joining. I believe that if the subscription were not more than Rs. 12—better, Rs. 6—per annum, each society could have a very large list of members, who would pay this sum to enable them not to get, as they would under the present rules, supplies of seeds, &c., gratis, but to purchase at low rates, which would recoup the society, plants, seeds, &c., just as they required them. The smaller subscription would support the societies in their good works, and they would become co-operative societies for the objects referred to.

It is so easy now-a-days to get out supplies of garden seeds from England or Australia, that unless there be a pecuniary advantage in doing so, people will not join the society in order to obtain the plants, &c., distributed by it. Public spirit exists, but it is few who can afford to exercise it at the rate of these societies' subscription. Another thing is that these societies have got to be looked upon as close institutions, the management being in, and continuing in; the hands of the same people for years together; and it is not likely, unless some degree of the popular element is admitted into their constitution and management, that they will attract members. Until they take up generally, and urge on Government strenuously, the duty, necessity, and advisability of endeavouring to promote agricultural reform, it also seems a farce for them to include the term "Agricultural" amongst their titles. At present, as far as the outward world is concerned, it is difficult to see how they merit the title.

A few years ago, I wished to join either one or both of the societies above referred to, but the rates of subscription (giving me privileges I did not want) frightened me off, and I am still—

NOT A MEMBER.

COTTON SEED.

TO THE EDITOR.

SIR,—I would feel very highly obliged if you could furnish me information as where to obtain the seed of a kind of cotton which I remember to have read something to the following effect:—

"Its cotton is extremely soft; the plant attains its full growth in 3 or 4 years, and lives for several years after that."

Should you favour me with the name of some other superior soft cotton, if I mis-remember the above particulars, and where to obtain its seed.

ISHAR PARSHAD PUNDIT,
Lahore, March 20, 1883. Head Teacher, Hindoo School.

The Indian Agriculturist.

CALCUTTA, MAY 1, 1883.

PLANT DISEASES.

(HEMILEIA.)

THIS is the familiar denomination of a fungoid pest (*hemileia vastatrix*) which, for the last ten or fourteen years, has mocked the efforts of coffee-planters, and the ingenuity of certain specialists. It exists to-day—a living proof of past and present neglect of the simplest laws of vegetable hygiene.

Appearing first in the remote district of Madulsima, in Ceylon, on young coffee planted in forest soil, no suspicion was entertained that its origin was due to starvation, or defective treatment. It indeed was for a time a puzzle even to such eminent mycologists as Berkeley, Broome, Cooke, Thwaites, and others; so much so that it could not be said to belong to any known class of fungi, although it was considered to be intermediate between ordinary mould and *uredos*. Since its identification, specialists have had to deal with the most varied and complicated aspects of phenomena, processes, and influences, while endeavouring to establish its characteristics, and yet, even after the lucid investigations of Mr. Marshall Ward in this direction, we are far from having attained proofs of its origin, or having sensibly retarded its progress. The pest still rages, and men who were rich are poor. Enough has been said and written on the life-history of the fungus: to this therefore we will not advert; we will further endeavour to steer clear of the atmosphere of theory with which this disease is so peculiarly surrounded, and proceed in a calm manner to consider why, after a ten-years' siege, so little has been accomplished towards its annihilation. Starting from the fact that the disease first made its appearance amongst young coffee, growing in virgin soil, we might on this account banish at once from our minds the idea of its being due to any defect in the soil itself, and would be supported in this by the knowledge that the disease was not confined to plants growing in soil which, from age, appearance, and out-turn, might have been classed as poor; but that, on the contrary, it raged amongst plants of the most apparently healthy type. We say *apparently*, because it is from this point that we will endeavour to show how planters have erred. It has been long agreed that the disease is a fungus; well, the question occurs, of what nature is the soil in which fungoid growths delight? Manifestly it is fermentative, and may be either hyper-organised animal matter or vegetable matter in a like state. In such matter, fungi *may* originate; in the presence of it, we know they fructify. These diseases, in short, may be due to decompositions as numerous and peculiar as are varieties of the order, and may be brought about by what is intended to be kind, but what we will endeavour to show, is really bad treatment. It is not our intention to enter into the mycological details of the pest in question: it is enough for us that it *is* fungus; we, therefore, must start from beyond the margin of circumstances which proclaimed its advent, and consider whether at or before this period, our mode of treatment was such as might have given rise to it. We will accept it then as a broad axiom that fungi luxuriate where decomposition prevails; that wherever this species of growth is seen, it ought to excite suspicion, for it is as much an indication of some internal disturbance, as are the appearances of scarlatina and small-pox. Coffee then, being infested by a fungus formerly unknown, points to the conclusion that by some means or other we have disturbed the conditions essential to healthy growth. It has been shown that this disturbance is not the effect of starvation; it is therefore very possible that it is the result of error. Were we ourselves to feed solely upon grass, we would be poor subjects.

Mr. Marshall Ward has discovered and demonstrated the laws of the operation of the disease. Beyond this he has not gone. We consider that to successfully contend against it, we must discover its origin. Practical planters have tried topical treatment of the most varied description, with the object of killing it: prominently the process of Storck, appropriated by Schrotky. The disease, however, is proof against all these, for no specialist has endeavoured to deal with the cause. They have, as it were, waged war against the fungus, without attempting to cut off its supports. Fungi, we have said, revel in decomposing or decomposible animal and vegetable matter. Is there anything in our present mode of culture that might induce this condition in coffee sap? That is, lead to a disturbance of the conditions of internal processes peculiar to this plant in a state of health? Has anything intervened or interfered with the circumstances under which, in days gone by, good crops were realised? Unhesitatingly, we say yes. Else the fungus, now so well known, but improperly considered, would not be new.

In animal life there are what might be considered two states of good health, *viz.*, that in which adipose tissue predominates, and that characteristic of muscle. The former we know to be most susceptible to decay, and the latter least susceptible to disease. The inference that the same peculiarities may hold good in plant life is not merely speculative. Pamper a plant with nitrogenous and saccharine fertilizers, and we have an apparently luxuriant growth, but we produce a readily decomposible or fermentible sap, capable of giving birth to fungi, and on which fungi, if the conditions giving rise to it be not speedily checked, would rapidly fructify.

It is thought by some that the disease must, like typhoid or scarlatina, burn itself out. This cannot be, so long as we supply fuel, nor can the most powerful anti-septics, while such conditions exist, do more than destroy the growth. Be they ever so penetrating, they cannot destroy the conditions. We must therefore supplement these certainly effective antiseptic measures against propagation, by more radical measures towards complete suppression. That is, we must check germination, and remove the conditions essential to evolution. For so long as evolution is possible, suppression of the mere external growth is futile. Assuming, then, that the coffee plant of to-day is too rich in easily fermentible constituents, and that consequently the absorption of mineral matter essential to hardy growth, and on the presence of which the stability of the sap depends, has been interfered with, our duty will be to discover in what manner this has come about. We ourselves do not pretend to have discovered this; but like lookers-on at the game of chess, imagine that we have discovered a false move, the which, as the game seems likely to be indefinitely prolonged, we would now point out. To be brief, we have, during the progress of the disease and for a considerable time before its advent, been fattening our plants instead of rendering them muscular, and so long as we continue this oleaginous treatment, we but fertilize the soil in which fungi revel, and from which, we repeat, even if we could simultaneously destroy all externally existing growth, fresh fungi would spring.

Most plants contain, in a more or less degree, certain unorganised ferments, the presence of which is proved by the diastatic action of their juices on starch; any excess therefore of organised matter, be it amylaceous, albuminoid, or mucilaginous, in the sap of plants, will call these peculiar ferments into play, and result in organised ferments, producing plagues such as have for years engaged the minds of workers in all departments of agriculture. That these rapidly multiply we know, and that they may blend and produce forms of a more virulent type is probable. Without therefore saying one word to detract from the value of external remedies, which at best are but powerful auxiliaries to fundamental measures, we will proceed to show how, under the present system of culture, diseased conditions may exist. To do this we must consider the question in retrospect, and ask ourselves, if, in the beginning, we neglected any ordinary hygienic precautions which may have given origin to the scourge. Everything points to such an omission. Want of railways forced planters to fall back on such fertilisers as were near at hand; of what did these consist? We speak from direct knowledge when we say that such fertilisers consisted mainly of the very elements which would lead to a fattening of the sap, a condition which could not, considering the robust nature of the plant, be achieved all at once,

but like anæmia in man, be a matter of slow process. The fertilisers, then principally used were coffee pulp, a readily fermentible substance rich in nitrogenous matter, gum, &c., but poor in mineral matter; cocoanut cake, a substance more highly nitrogenous, containing sugar and gum, but still poorer in mineral matter, and castor cake, even more highly nitrogenous, and poor in mineral matter: these with ordinary field and stable composts were the agents *then*, and we think now, much in vogue. They were, we know, long before the advent of the disease, and for a long time afterwards, lavishly applied. It is true that some planters more enlightend and more persevering than others, did at intervals apply bone-dust, and like substances, but these men were few in number, and it is questionable whether, in the presence of an excess of organic matter, absorption of the essentials applied could have gone on to any appreciable extent. Given, then, these circumstances preceding and following the disease, we have not far to seek for its origin. That the disease has not succumbed to topical remedies calls for no surprise. The Germans, with all their power and *éclat* of victory, could not reduce Metz; the French succumbed to that power which no life can withstand—starvation. So must hemileia. And surely as the conditions which gave origin to it remain, as surely will it continue to grow. No matter how much of the fully developed fungi we may kill, we are not one step forward: our attention must therefore be directed to cutting off its supports. This we say after a matured practical study of the disease, and subsequent consideration of the numerous views regarding it, expressed in that eminently practical organ, the *Ceylon Observer*. We have looked on for many years, hesitating to add to conflicting current opinion, but as the disease affects us in South India, we can no longer keep in reserve our privilege to speak. We repeat, then, that it appears clear to us that if we are ever to succeed in mastering the plague, we must give our best attention to fundamentals, and that our first duty in this direction will be to destroy the conditions essential to its development, the first step towards which will be the abandonment of the use of the highly nitrogenised fertilisers mentioned. Next, we must endeavour to discover by examination of plants which have not been affected, that is, plants grown where the disease is as yet unknown, the characteristics of truly healthy sap, to get, in fact, at its exact constituents, so that we may compare it with that peculiar to diseased conditions, and so be able to judge when we have brought it to a a healthy state; and when at any future time like indications of disease occur, we may know in what way we have deviated from necessary conditions. Judging from the agreement in certain essential effects, brought about by the combined action of auxiliary remedies, such as carbolic acid, sulphur, &c., with tonic treatment, we are sanguine that the same treatment, *after we have completely withdrawn the evil influences mentioned*, would, if universally adopted, free us from the pest. But we emphatically say that even should we discover a specific, which would penetrate into every fibre of the plant, and so destroy every spore, the disease, unless we are prepared to use the remedy in perpetuity, would reappear with as great virulence as ever. We must adopt measures to prevent further growth, and this we can only do by withdrawing the essentials to growth, and withholding the same for a considerable time from the soil. In the Journal ofthe Agricultural and Horticultural Society of India (Vol. VII, Part I) three is a reprint of an excellent paper by Mr. Carruthers, F.R.S., in which it is fairly demonstrated that wheat mildew and rust are one and the same fungus in different stages of development, and that a still earlier stage exists in the shape of the *æcidium* on the leaf of the barberry. From this it might be reasonably inferred that hemileia, phylloxera, and such like pests are also higher forms of other fungi. Bearing in mind the relationship of hemileia to common mould, we would to a certain extent be inclined to favour this view, especially knowing as we do that the forests in the vicinity of Madulsima, where hemileia was first seen, abound at certain seasons in low forms of vegetation. But, we argue, such were not new, and that had the coffee first affected not offered a ready nidus by reason of its diseased condition for the spores of these lower forms of fungi, granting it to have originated in this way, we should never have heard of the disease. If it is contended that the coffee at this time was perfectly sound, we would ask why the spores of the lower fungi, such as from which it may have sprung, did not in earlier times find on it a congenial soil. It might be here answered that the primary form had only at this time sprung from something else, that it was the result of the blending of several heretofore known fungi under peculiar conditions, in the humid depths of the forest, and that when the dry season came round, the spores of this new creation were projected into the atmosphere, and chose as their habitat, coffee. We say again, however, that had the sap of the plants at this time been healthy, no form of lower vegetable life could have germinated therein. Whether or not, however, the disease had its origin in this way, or whether of primordial growth when first seen, is a matter of little consequence, for the remedy would in either case be the same. Mr. Carruthers, concluding his remarks on the wheat pest, says:—"From the history of the fungus, it is manifest that at no stage is it under our control, and though we can take steps which may prevent at different stages the unnecessary increase of the spores, *we must be baffled in any attempt to prevent the appearance of the disease, whether in the rust or mildew stage.*" We take objection to this conclusion, because we do not believe that fungi can come into existence, or thrive elsewhere than in unhealthy places; their habitat is the morass and the swamp, the interior of forests, badly drained fields, sewers, cesspools, and places where the full influence of the sun and the atmosphere is not felt. They are as surely the result of a bad state of things, agriculturally, as are typhoid and malaria, from a sanitary point of view. and presumably like those latter may, if we go the right way about it, be stamped out. It is to be regretted that Governments have neglected to apply the resources for the discovery of causes and the means of removing them, which the knowledge of our time renders possible. Contented with various curious discoveries, they do not seem to realise that certain changes and deteriorations in important staples are, bad though they be, but indications of greater mischief. Does the study of coffee disease lie outside the duties of Agricultural Departments?

THE IMPROVEMENT OF INDIAN AGRICULTURE.

LAST year, amidst a great flourish of trumpets, Mr. Buck published a resolution of the Supreme Government on the organisation of Agricultural Departments in the various provinces. It contained a number of statements which no one could dispute, and pointed out how it is incumbent on the State to do all it can in India to promote progress in agricultural matters; it also contained many statements, such as that, for instance, regarding the necessity of deferring action until more information has been collected regarding the condition of the country and the people, which are not only incorrect, but very misleading. Half-a-century and more of rule has put the Government of this country in the possession of sufficient facts, *if only they would read them rightly*, to guide its action in promoting agricultural reform. There is also the experience of the methods adopted in all parts of the civilised world from Great Britain to Japan, to show them how to proceed. However, our rulers have preferred to proceed in a slow manner, and it will be useful to see what is being done.

The main idea evolved in Mr. Buck's resolution was the combination of the work of revenue settlement and agricultural improvement in one department. This of course is a most ill-advised course, because it will cause all the efforts for improvement which may be made, to be looked upon by the ryots as so many endeavours to find excuses for increasing the land rent. Very little experience is necessary to make any one aware of the fact that the ryots look with suspicion on all efforts promoted by their landlord (the State) to bring about an increased rate of production from the soil, no matter how truly disinterested the views of the Government may really be. What, then, will be the ideas of the ryots when they see the self-same officers, who are engaged in fixing the rent, doing all they can to induce them to improve their systems of husbandry, and thereby give an excuse—as the ryot will believe—for increasing that rent? The idea has, however, been accepted by most of the local Governments, and is being carried out, but

ery little else has been or is being done. It will be well to ee what is being done in the two provinces where agricultural mprovement has hitherto received most attention—*viz.*, Madras nd the N.-W. Provinces. The former province has for many ears now had in its service a specially trained agricultural xpert, and under him has maintained an experimental farm n which many useful investigations have been carried ut; it has also for the past six or seven years been upporting an Agricultural College, which has been doing ood work under considerable disadvantages. This work as begun to shown signs that it is having effect in the outhern presidency, as we have recently heard of native entlemen, owners of large property, taking to agricultural ursuits, adopting improved implements of husbandry, nd employing the trained men turned out by the Madras College as their managers. We cannot think, however, that early as much has been, or is being, done in Madras as the neans at the disposal of the local Government would admit f. It is very probable that Mr. Robertson has been rippled in his efforts by want of support from his superiors, or we find frequently in his reports references to schemes or extending his work, but in after years no further reference o them. It is a great pity that the Madras Government do not see their way to extend the work of its agricultural fficers, of which they now have two highly trained and of considerable experience in India, and they must, amongst the nen who have been educated in their Agricultural College, ave abundant material for widely extended operations. Mr. Robertson was not long since appointed Agricultural Reporter to his Government, whatever that may mean, and it was then stated that he was to report on the whole of the Madras Presidency with a view to devising means for dealing with it agriculturally so as to avert famine. No doubt the work could not be put into better hands, but now one man was to be able to perform it in the ordinary course of an official life in this country does not seem to have struck the person who proposed it: it is in fact impossible; and made the more so as Mr. Robertson was to carry out the duty in addition to all those he has heretofore performed, and which for eight or nine months in the year tie him to his head-quarters at the Agricultural College.

At the same time that the extension of Mr. Robertson's duties was made, the Madras Government appointed its Director of Revenue Settlements to be Director of Agriculture. What the value of this step may be it is difficult to surmise. We have already indicated the evils likely to result therefrom. The able officer who is appointed to fill this post is probably, like his companions in the Revenue Department, as innocent of agricultural knowledge as a new-born babe, and there are signs of his already having "put his foot in it," if we are to believe the Madras papers; whilst we also see that not long ago the Madras Board of Revenue wanted Mr. Benson, when acting for his superior during an absence on furlough, to revert to the old exploded idea of endeavouring to teach the adult ryots by means of a commercial farm conducted by Government. This last idea shows that although in many ways the epithet "benighted" is inapplicable to Madras, in things agricultural it is benighted enough and we fear that the newly appointed Director of Agriculture may, like so many others who have not studied the subject thoroughly, be led away by plausible arguments, and force on his department an incubus which we are glad Mr. Buck had the clear-sightedness to relieve the operations of the N.-W. Agricultural Department from, whilst he was directing them. Besides its direct agricultural operations, to which we have referred, the Madras Government are forming a strong veterinary department, which will combat and endeavour to suppress cattle-disease. These operations cannot fail to do great good to the country, but until our live stocks are better fed and cared for, tremendous losses must frequently take place amongst them.

Turning now to the N.-W. P., the only other province which has as yet made any real profession of work in this line, what do we find?—A department called that of Agriculture and Commerce, and devoted almost entirely to the collection of statistics and the supervision of land revenue subordinates. If the latter duty were carried out by such trained agents as a landlord in Europe would almost solely employ, the department would, or might, be fulfilling a great work. Besides this, the department has an Engineer officer endeavouring to find a way to cure the ills caused by the mistakes of ignorance of former engineers, *viz.*, the effect of *reh*. Again, there is the Cawnpore farm on which Mr. Fuller has been doing as good work as could be expected on so badly selected a site, but jumping to conclusions on altogether insufficient data' as was also to be expected from an amateur. Experts are liable enough to this mistake, but when amateurs are taken with an idea, it usually carries them away. "Nitrogen" is no doubt an element which is very easily exhausted, but to make it a password on the strength of a few isolated experiments is a gross blunder. On this farm, we were led by the last report of the Director to believe that a college, something similar to that at Madras, was going to be started. The idea was under discussion in December 1881, and the Director stated that Mr. S. Hill was to be the Principal of the College; that gentleman is now going home, so we must believe that the plan has broken down, whether from differences of opinion between Mr. Buck and the local lights, or from an ill-advised refusal of sanction from the Secretary of State, it does not matter much, as, whatever the cause, the occurrence is most lamentable, and coming just as the department was apparently taking a new departure in a right direction, will be regretted by all who have the interests of Indian agriculture at heart.

In the other provinces of the Empire, very little has yet been done. In Bombay there is an agricultural class in connection with the College of Science at Poona, but it is not doing much, nor can it be expected to, unless placed on a firm and efficient footing. Perhaps Mr. Ozanne will be able to do something when he returns to India after his study at Cirencester. In the Central Provinces, Mr. Fuller is doubtless infusing his energy into the operations of the local authorities, and we only hope that he will be able to do something satisfactory with the Nagpore farm. In Bengal, the Lieutenant-Governor goes on throwing away large sums of money in sending young men to Cirencester, who, on their return crammed with book knowledge (for we are credibly informed that at Cirencester the Bengal students are of no use outside the College) will have to spend two or three years in learning how to apply what they have learnt in England to Indian conditions before they will be of any use. The money spent on these scholarships (something like £900 a year) would educate about 40 or 50 students at the Madras College, where the students, in addition to obtaining a very similar theoretical knowledge to that gained at Cirencester, would have seen it applied to Indian conditions, and so have been, at the end of their studies, much better fitted for immediate service. What the Bengal Government is going to do with its students when they they return from England, as two shortly will, has not yet been announced. In Burmah, Assam, and the Punjab, officers have been appointed in accordance with Mr. Buck's resolution, but it does not seem that they know very well what their duties are or may be. In fact, the whole question of the organisation and duties of these new Agricultural Departments requires overhauling, and the details worked out by specially qualified persons. It is very easy to sketch out a general scheme for anything, but we hope that the local officers appointed under Mr. Buck will be able to work out thoroughly practical methods for attaining ends which it professes to have in view—the improvement of Indian agriculture.

THE BENGAL AGRICULTURAL SCHOLARSHIPS.

IN a separate article, we have summarised briefly what is being done in India for agriculture by that resuscitated gemini of a department, the Revenue and Agriculture. We have stated our conviction that the combination of revenue and agricultural duties assumed by the department or rather the imposing of some of the work of the department on revenue officers, thus identifying in the minds of the peasantry the fixing and enhancing of the revenue, with almost everything

emanating from the agricultural bureau—in short, the rolling of two single men's duties into one, is likely to produce distrust, and veiled opposition, among the ryots to every single improvement proposed by the agricultural authorities; and instead of furthering agriculture, materially retarding it. We hold that until officers properly qualified to deal with the intricate problem of Indian agriculture, not merely jacks-of-all-trades who can be pitchforked into all sorts of square and round holes, are officering the department from its highest to its lowest grades, not only will a steady, determined resistance to the plans, suggestions, schemes, &c., of the Agricultural Department be raised up among the peasantry, all the more steady and determined, because seemingly acquiescent, but well-meaning clever men, full of theory, and, it may be, crammed with the latest and most advanced text books and scientific treatises, will work mischief almost irreparable, and air their fads in resolutions and reports, and before a wondering peasantry, who will listen, look on, and if they do not laugh at the *saheb* when his back is turned, will wonder what it all means. The very substantial agricultural scholarships instituted during the time when Sir Ashley Eden ruled Bengal, and since then further developed, are, we venture to affirm, better fitted for a people centuries in advance of the average Indian peasantry. What connection there is between mere power of cramming the contents of books for the purpose of disgorging them at examinations, and an intelligent study and practical acquaintance with the various operations implied in rural life in India, is probably known best to the well-meaning men who planned the Bengal Agricultural scholarships. We venture the opinion that there is scarcely a student at Cirencester College who at a pinch could not perform every single manual operation necessary on an English farm—from cleaning a byre to buying or selling a pig at a market; who could not plough and trench, sow, groom, milk, &c., with more or less skill. To place men of this stamp in the same category with the contemptible men of books and examinations sent to Cirencester from Bengal, men who never twisted the tail of bullock, or carried a plough on their shoulders unless by proxy, is to insult the former, and to expect from the closet student the knowledge of the practical man of the world. We do not by any means undervalue intellectual training and knowledge derived from books, but we hold that the qualities most imperatively desirable in all who aspire to become the leaders and teachers of agriculture in India, are the power of accurate observation and of exhaustive experiment, based on a practical acquaintance with the whole details of agricultural and rural life in India. To confer such rich scholarships as those of Bengal on clever bookmen, distinguished university students who have shown no aptitude for, or knowledge of, the work of an ordinary ryot, who probably could not distinguish one crop from another if asked to point out one or other as they stood in the field, and whose ignorance of things agricultural is contemptibly conspicuous, is, to say the least of it, astounding. We are prepared to hold that of all places in the world least suitable for the teaching of Indian students of agriculture, Cirencester is the worst. The class of students mainly found at Cirencester are composed of the sons of wealthy farmers, land-owners, and it may be younger sons of the nobility, a fair proportion of whom, as in most educational establishments, attended by the sons of the wealthier classes in England, are, to say the least of it, not absorbingly devoted to study. Luxury, leisure, and lectures are not the best preparation for the study of Indian agriculture. Indeed, it seems to us a gross waste of public money to send these clever Indian young men to Cirencester, to acquire a more or less thin English veneer, a parrot-like knowledge of crops, rotation, soluble phosphate, manuring, farm machinery, and costly English and Continental methods of working and winning crops in order to return to India, and impress these and such-like theoretical teachings on Indian ryots, whose whole household, farm animals, and labourers could live for a week on what it cost the Bengal agricultural scholar for a game at billiards in England. We ask the Government of Bengal what it expects from those Cirencester scholars, who are now being steadily manufactured at public expense? What have any of them done for agriculture, or what does the Government expect them to do for agriculture when their scholarships are ended? Will it provide them highly paid posts in the harmonious gemini department of Revenue and Agriculture, and leave them for the rest of their official existence, to do revenue work, and write smart essays by way of reports and returns? If this is so, then there are hundreds of young men in India who could be trained to that sort of thing at considerably less expense. On many occasions in the pages of this journal, we have ventured to counsel the Imperial and Local Governments on matters agricultural; but it is probably no part of the duties of a public journal to teach Indian departments their work, and show them how to effect it best. It does, however, seem to us that there is a gross and unjustifiable waste of public money in founding such rich scholarships as those of Bengal, when, in the whole province, there is scarcely a pice spent in any legitimate effort to teach the peasantry, or inoculate proprietary ryots with ideas on agriculture other than those which they and their fathers have followed with unvarying routine for ages. This mere playing at agriculture is wasteful and disgraceful, and the sooner it is ended the better.

THE YELLOW PAMPHLET.

THE yellow pamphlet, "Indian Wheat *versus* American Protection," has been much honoured. It has been noticed in the budget, and has recently formed the text of a letter from the Bengal Chamber of Commerce to Government. And it contains some very useful statistics. It is, however, disfigured by some highly seasoned criticisms of a not very profound sort, and is more destructive than constructive in its tendencies. Nor is it always accurate. And this last is a serious defect.

At page 20, we find—"The lowest rates ever sanctioned "for the carriage of grain by rail are on the Punjab Rail- "ways, *viz.* (1-7th pie per maund per mile) 0·746 shillings "per quarter per 100 miles, ... and are considered to "be so probably unremunerative that the present nerve- "less management of the lines have never given the public "the advantage of them. But all the same, we must not "withhold our admiration for the enterprising and far- "sighted policy of the Board of Directors of the Sind, "Punjab, and Delhi Railway, &c., &c." This is eloquent enough. But it is unfortunately not in accordance with facts. At certain seasons of the year, the rate mentioned, 1-7th pie, exists, and the public has advantage of it on both the East Indian and Oudh and Rohilkund Railways. *Videri quam esse* has, for so many years, been the policy of the Punjab, that it is not surprising that others act while the Punjab only legislates. The point is, however, whether 1-7th pie, which is equivalent to one-half-penny a ton per mile, is not too high. That lower rates than are at present quoted could be given to the public seems to be undoubted from the following consideration. Official returns show that on the East Indian Railway the average cost of moving one ton one mile is pies 2·34, and the average profit pies 4·09. In other words, there is a profit of about 200 per cent, which leaves a large margin for a reduction of the average rate on the railway. If railway managers could only be brought to understand that a low rate and a wide public is the most profitable form of business in railways as in other transactions, what a revolution in things there would be, and how rapidly the public which pays the railways would increase in area.

We are entirely with the author of the pamphlet in his main object—the reduction of rates. But we doubt if he is right in his denunciation of extravagance on Indian lines. We believe that they are generally managed economically. We have never seen a comparison made with American railways; but one with English railways was in favour of the Indian concerns. However this may be, the economies which could be enforced would probably not be very great, and, with profits of 200 per cent on cost of carriage, do not require to be made on the East Indian, at least before the experiment of lower rates could be introduced. On other lines, particularly on the Punjab line, the margin is smaller. But there ought to be little alarm in making the experiment anywhere, for all experience in all business is in favour of low profits and large sales.

One of the most remarkable facts mentioned is in the last appendix of the book, namely, that Government, in the *face* of the fact mentioned above, that 1-7th pie is a rate in operation on two railways in India—a fact which ought to be known to authority—has, in its contracts with the South Mahratta and Central Bengal Railway, limited its power to reduce rates below ¼th and ⅓rd pie respectively. We wonder who the advisers of Government were in this matter. If private enterprise cannot be encouraged without mischievous reaction of this sort, it is a question whether it should not be abandoned in favour of some other policy.

The first object of the writer of the pamphlet is the reduction of rates, this has our entire sympathy. So has the second object—the more rapid extension of the railway system. This our author would achieve by capitalising the sum now yearly spent on productive works, and spending it at once. Thus, taking the annual sum at two millions, he would spend the equivalent capital of 50 millions in building 20,000 miles of railway in 7 years. This question of capitalisation is not new. It was, we believe, submitted to the Secretary of State, and vetoed. But, supposing that it should be permitted, we think the author of the yellow pamphlet is going rather too fast. The sudden construction of 20,000 miles of railway would seriously derange the produce and labour market, raising materially both the cost of work on the line and the price of iron placed in it. About 12 years ago, as is well known, the very rapid extension of railways in America had this effect—making the fortunes of English iron and coal masters, and vastly increasing the cost of both minerals, to the injury of railways both working and under construction. Perhaps, however, the writer is speaking hyperbolically; and that some more rapid rate of progress is needed, we readily admit. And not only is it desirable in Indian agricultural, but in Indian manufacturing, interests also. If it were certain that railways would be rapidly extended, it would pay capitalists to set up in India iron-works on a scale of sufficient magnitude to make such concerns profitable. Could not the Secretary of State be induced to permit partial capitalisation of the two millions? If, for instance, so much of it were capitalised as to produce 10 instead of 50 millions, a great deal might be done which is now impossible.

The author of the pamphlet is hard upon Government as financiers, but he surely falls into a fallacy himself. In discussing capitalisation he says—"And as to increasing "the amount of sterling debt, that *bête noir* of the Indian "financier, nothing would be easier than to arrange that "the guarantee was to be given to the company, not on the "amount of sterling lodged in the treasury at home, but "on the amount of rupees lodged in the treasuries in India. "This simple arrangement would turn the whole into a "rupee loan." Quite true; but what is the advantage of a rupee loan? The *bête noir* of the Indian financier in respect of sterling debt is not the sterling, but the loss on exchange. But how does a rupee loan remove this loss? It of course cannot do so unless the holders of stock are in India, and spend the dividend here. But the experience of railway undertakings is against this. The shareholders are all English, with an exception too insignificant to be of consequence. The result is that the dividend, even when paid in India, is remitted to England; there is, consequently, competition for gold, and the silver is depreciated. It is true that while the stock is being paid up, the contrary operation takes place. For then there is a competition for silver, and it is appreciated. But this is merely a temporary alleviation. We do not think, therefore, that the author of the pamphlet has here given financiers any useful suggestion.

What he says about guarantees is more to the point. As it is now undoubted that all Indian railways, taken together, on the whole, pay, a guarantee is no extravagance; but on the contrary, if it tends to attract capital not otherwise obtainable, it is extremely useful. And if private enterprise is to have the oyster, and Government only the shells, the average returns may be reduced, and guarantees of a nature to attract capitalists become impossible. That private enterprise may, therefore, be injurious to the country, if the profitable lines are lightly made away with, is quite possible.

The author is particularly hard on the body-guard at Madras, which idles for eight and works for four months. We suppose he must know something of the Viceroy's body-guard and its work: why should Madras alone be mentioned? The truth is, that so long as there are Viceroys and Governors, these things must and ought to be, especially in the East. The remarks about useless buildings seem to us to be too sweeping, though, to particularize, we may say that the defacement of Writers' Buildings seems to us a wanton extravagance, especially as all the interior arrangements of the building are less convenient than formerly. The author also must live in very high places, if his chuprassees get Rs. 84 a year. Usually they receive Rs. 60—not a very brilliant stipend.

He complains that one million is spent upon unproductive military expenditure. But how is this to be avoided? So long as there must be an army, there must be buildings. The army, though unproductive itself, makes possible useful production on the part of others, and is, in the present state of the world, we fear, a necessity.

The author is apparently a strong advocate for uniformity of gauge. This fighting for one standard has always seemed to us a mistake in India. It may have been an error to construct the Rajpootana line on the metre gauge. It would have been a far greater error to construct the Muttra-Hattrass railway on a gauge of 5 feet 6 inches.

In his contrast of America and India, he leaves out of sight the fact that Americans are willing to invest in the railways of America, but that Indians are not prepared to invest in Indian railways.

Mr. Grant White, who, as an American, may be supposed not to be prejudiced against his country, considers that English railways, in the matter of passenger-travelling at all events, are to be preferred to American. Nor are American railways always managed for the shareholders and the public, but for speculative rings—so that the policy employed cannot always be safely appealed to. "The public," said Vanderbilt lately, in reply to a remonstrance against some policy of his, "the public be damned."

THE JUTE INDUSTRY.

TO those people who are under the impression that the present exceptionally good times in the jute manufacturing industry here are likely to be permanent, a word of warning at this moment may not be altogether inopportune. At the outset, we would remind our readers that there is another place besides Calcutta where jute manufactures throve long before many of our Bengal mills were in existence—an ancient town full of wealthy and enterprising traders, who are not likely to let the business slip through their fingers, without making a strong effort to retain it—we allude to Dundee. Dundee, as most of our readers are doubtless aware, has been the seat of the jute manufacturing industry from the commencement: it has the finest jute mills in existence, and the experience of the most capable and practical men in the trade. For some years past, until very recently, competition between Dundee and Calcutta was very keen, and though Calcutta has wrested many a market from its older rival, the competition was very close, and many a company here had almost bitten the dust ere the game was scored for Calcutta. But though Calcutta has the advantage in many respects of Dundee, that advantage is, in our opinion, only felt when profits are at a minimum; and when, as in the past year, mills are earning 30 per cent and more, we expect that Dundee can fully hold her own.

Advices from Dundee intimate that a change has come over the state of the jute trade during the past few months, shown not only by the full employment and increased wages given to the working classes, but also by the re-opening and extension of mills and factories in Dundee and its neighbourhood. The production, it is said, has been very materially increased of late, and will shortly be still further extended. During the latter months of 1882 several mills were re-opened, the most important being the Hillbank Spinning Company, the Grove Mill, the Logie Works, and the Westfield Mills, besides many important additions being made by the firms. The *Dundee Advertiser* in a recent article says:—"There is plenty of evidence that the production is being materially increased in other directions. Looms are being quietly added here and there, and looms which have been some time standing are now, or will soon

be, going again. In Forfar jute cloth is becoming a most important part of the production, and the number of looms employed at the five grades of hessians, mostly mangled, is now very large. How far this increased production is justified remains to be seen. After so long a period of dulness producers seem anxious to anticipate good trade, and are evidently to be well prepared for it. Up till now they certainly have not reaped much of the benefit, for few have yet got their dear purchases worked up, and it is *the cheapness of jute* which forms the encouraging element of safety to spinners and manufacturers at present. The demand, especially for yarns, continues very good, but whether Dundee can increase its export both of yarns and cloth sufficiently to meet a further important increase in production is questionable. The trade is undoubtedly large, but it is no longer confined to Dundee, neither is the extension of works by any means confined to Dundee,—the very large increase in Calcutta should be kept steadily in view,—and it does seem as if the production were keeping pace with the increase in consumption, if not more. While pleased to see such signs of returning prosperity manifesting themselves, it is well to remember that its duration may be made shorter by an excessive production."

In Calcutta extensions are going on by leaps and bounds; the Hooghly Mills with 300 looms are in course of erection, so are an additional 200 looms to the Howrah Mills; the Kankipara Mills with 300 looms are also under construction, so is a mill of 500 looms for the Samnuggur Company. The Goosery Jute Mills are about to put in another 74 looms, and we suppose that the addition to the Budge-Budge Mill will be not less than 180 looms. Messrs. Macneill and Co. are reported to be putting up a mill, and we observe that the Victoria Jute Company, Limited, has been floated in Dundee, with a capital of £200,000, for the purpose of erecting a jute manufacturing work in the neighbourhood of Calcutta, and carrying on the business in connection therewith, the Board of Direction consisting of well known Dundee gentlemen of long practical experience in the trade. Under these circumstances it would be as well if investors carefully reviewed the situation. At the present moment, consequent upon the very large profit made in 1882, jute mill stock is abnormally high. There is every probability that these large profits will be sustained during 1883, but with the close of this year we anticipate that things will return to their normal condition, if indeed there is not another crisis in the industry. It is absurd to suppose that the present high profits can be maintained; at the same time, the jute manufacturing industry isa perfectly honest and legitimate one; and if extensions are gradually introduced, and the manufacture is conducted with the necessary skill, care, and caution, a reasonable profit should always remain to be divided among the shareholders.

To show how the trade has developed, we quote the following from the *San Francisco Commercial Herald*:—"The annual consumption of bags and bagging for the Pacific slope has grown to such proportions as to overshadow most other descriptions of imported merchandize in value, and they are consequently becoming more a daily article of speculation and investment. A few years back, and between the months of September and April they were scarcely heard of, whilst now there is scarcely a day, certainly not a week, in any month, in which hundreds of thousands, sometimes millions, are not sold. As an illustration of this speculative action, a California-street house, that makes dealing in jute goods a speciality, on the 1st September last bought over five millions of Calcutta bags, and re-sold the whole in a few days at a small profit for delivery from January to June." These large speculative transactions are, however, often a source of danger, as a heavy failure demoralizes the market, as was the case a few months ago.

The exports of powerloom gunny bags to San Francisco, during the last four years, were as under: 1879—18,889,518; 1880—22,412,779; 1881—19,227,774; and 1882—16,495,380, while the shipments for January 1883 were no less than 7,620,900. It will be seen that there has been a steady falling off during the last few years, though the present year has opened well. We observe that the shipments to Australia are steadily on the increase, no less than 18,652,061 bags having been exported thence from here in 1882, as against 15,503,852 bags in 1881; 10,200,528 bags in 1880, and 10,605,942 bags in 1879. Australia and San Francisco are the two chief places to which we export our bags, and it seems reasonable to suppose that we cannot undersell Dundee in ordinary times, and retain a profit of 20 per cent. We observe that, during the last few months, shipments of gunny bags have been made to the United Kingdom from here, which in our opinion shows that Dundee at present is full of business. During the present season, jute has ruled cheaper in London than it cost to lay it down, which is all in favor of Dundee.

MAJOR COUSSMAKER'S EXPERIMENTS.

MAJOR COUSSMAKER'S experiments in tusser sericulture in the Bombay presidency have not, it appears, met with the success anticipated. He is about to leave India, and in his last report, which has just been submitted, he says he cannot recommend Government to continue the experiments, as there seems little prospect of their proving remunerative. There are three causes which have led him to come to this conclusion. Wild silk, he says, is now exported very largely from China, and the price of tusser waste has therefore fallen to 1*s.* 3*d.* per lb. in England. The tusser cocoons of the presidency are also said to be smaller, and contain less silk than those found in other parts of India, while the expense of collecting the cocoons or of rearing the worms in a state of semi-domestication is said to be great.

During the year 1882, Major Coussmaker's collection amounted to 25,031 cocoons, weighing 57½lbs. Some cocoons which he sent home last year to Mr. Wardle to be sold, fetched 1*s.* 3*d.* per lb., and the report of the buyers was "that the fibre from these cocoons is somewhat coarser than most tusser waste, and the cocoons have been opened; but this is not a serious drawback to its spinning qualities. China is now sending over such large quantities that the price of tusser waste is very low." In his attempts to increase the size of the cocoon by importing some of the large variety from Sumbulpore, Yamtasa, and other places, Major Coussmaker has not met with success. The moths, he says, have paired readily, and the worms have hatched out, but there has been no difference in the cocoons. This failure to improve the breed, Major Coussmaker attributes to the climate, and perhaps, he adds, the difference of food may be another cause. As far as quantity is concerned, it appears the result of rearing the tusser silk-worm in semi-domestication is most satisfactory. Major Coussmaker writes: "I have now been able to gather within six weeks three cocoons per running foot of hedge. My first worm, this last season, was hatched on the 9th May, and the first cocoon was gathered in 32 days' time. Of this particular batch of worms, I took careful notes; they numbered 380, and 347 of them spun cocoons, commencing on 7th June and ending on the 24th idem. They consumed 110 running feet of hedge, a few feet of which consisted of cuttings that had been kept growing for a twelve-month, but the greater part of their existence was spent on a Lagerstrœmia hedge, which on the 1st May had been cut down to 2 feet in height, cleared of every twig and vestige of a leaf, irrigated every third day and enclosed within tarred screens of split bamboo, over which a coarse cotton covering had been stretched on rattan hoops; as fast as this hedge was eaten off, it sprouted again, and by the time the worms had reached the far end, the new shoots on the first tree were covered with leaves."

Major Coussmaker tells us that in his experiments he has only attempted the collection of tusser waste, but he considers it most probable that the production of perfect dry cocoons ready for the reeler, or reeled raw silk, may be more remunerative. Major Coussmaker puts on record in his report some valuable information regarding the bleaching of tusser silk, which has been placed at his disposal by Mr. Wardle. This gentleman, it appears, has made several experiments in overcoming the defects in tusser silk, and has proved successful in his attempts. Mr. Wardle's method, which will no doubt be of interest to those interested in the silk industry in this country, is as follows:—Mix in water, well impregnated with soft soap, carbonate of soda crystals, equal in weight to one-quarter of the silk to be bleached, and immersing the silk, boil it for a little more than half-an-hour. Then wash it

thoroughly first in hot, and afterwards in cold, water, until it is perfectly clean. Next, put it into a narrow deep vessel, and having added a few drops of ammonia to the liquid peroxide of hydrogen, so as to make it alkaline, pour it over the silk, until it completely covers it. The silk, while undergoing this treatment, must be kept perfectly in the dark, and if the peroxide does not remain alkaline, a little more ammonia must be added. Keep the silk in this state for 24 hours, then heat up the mixture till its temperature reaches 120°—130° Fahr., and let it remain at this heat for 12 hours, when it will be found that the silk has become bleached.

Although Major Coussmaker's connection with these experiments will now cease, we observe that the experiments are not to be entirely abandoned, as the plantations, &c., are to be transferred to the central jail at Yerroda, where it is probable they may be continued, as the authorities, according to Major Coussmaker, have always taken an interest in them.

COTTON IN THE PUNJAB.

THE year 1881-82 was on the whole a favorable one for cotton cultivation in the Punjab, and compared with the results of the two previous years, there is, during the period under report, a sensible increase in the area cultivated and in the outturn and value of the crop. The area under cotton and the outturn and value in 1881-82, compared with the results of 1879-80 and 1880-81, are as follows :—

	Area in acres.	Outturn in cwts.	Value in Rs.
1879-80	806,380	644,483	1,21,12,122
1880-81	761,729	653,917	1,31,08,069
1881-82	918,265	787,581	1,46,34,850

From the above figures, it will be seen that there has been an increase in area of 156,536 acres, and in outturn 133,664 cwts., and in the estimated value of Rs. 15,26,781. Though these estimates may have been capable of improvement, the Local Government considers that they may be taken as a fairly correct statement of the actual results of the year. The average outturn per acre for the province in 1881-82 was 96lbs. of cleaned cotton, or the same as for 1880-81. The district averages vary from 238lbs. in Jullundur to 28lbs. in Sirsa, where it is said that the crop was unusually poor owing to the heavy and unseasonable rain and the ravages of insects. The divisional average for the 10 cotton divisions vary from 58lbs. in the Rawul Pindee division to 149lbs. in the Umballa division. We observe that for some of the districts, the average outturn is placed very low, and in others very high, and it seems doubtful whether, in these instances, much reliance can be placed in the figures. The case of Kangra in the Jullundur division is specially noticed in the report. Here the estimated out-turn per acre is placed at 29lbs., and the Local Government is of opinion that this can be by no means a correct estimate for so favorable a year as that under report.

The cost of cotton cultivation per acre is given under the following heads :—

(a) Lands irrigated and manured.
(b) Lands irrigated but not manured.
(c) Lands unirrigated but manured.
(d) Lands unirrigated and unmanured.

Under (a) the cost varied from Rs. 11-11 in Goorgaon to Rs. 37-13-4 in Jullundur; under (b) from Rs. 6-12 in Goorgaon to Rs. 30-15-6 in Jullundur; under (c) from Rs. 6 in Goorgaon to Rs. 25-15-6 in Jullundur and Umballa; and under (d) from Rs. 5 in Goorgaon to Rs. 17-11-11 in Jullundur. Under all four heads, therefore, the cost of cultivation has been lowest in Goorgaon and highest in Jullundur. Here, again, we notice that the authorities are inclined to doubt the correctness of these figures, and the hope is expressed that the agricultural department of the province, recently established, may be able in future to assist district officers to improve statistics of this kind. The average retail and wholesale prices of cotton per cwt. in the Punjab for the year 1881-82, compared with the year 1880-81, are given in the following table :—

Retail price per cwt.		Wholesale price per cwt.	
1880-81.	1881-82.	1880-81.	1881-82.
R. A. P. 21 7 3	R. A. P. 19 7 5	R. A. P. 21 12 1	R. A. P. 18 7 6

The retail prices vary from Rs. 65-6 per cwt. in Jhelum to Rs. 28 per cwt. in Rawul Pindee, and the wholesale prices from Rs. 15-14-3 per cwt. in Rohtuk to Rs. 25-8 per cwt. in Peshawur.

The total amount of cotton imported during the year was 58,058 cwts., or 836 cwts. less than the imports of the previous year. In the total exports of the year, there is, however, a very satisfactory increase; the quantity exported amounted to 224,418 cwts., or 83,560 cwts. in excess of the exports of 1880-81. To this increase, Umballa, Jullundur, Goojranwala, Mooltan, and Lahore have chiefly contributed. Of the total exports of 224,418 cwts., Calcutta took 54,679 cwts., Bombay 15,089 cwts., North-Western Provinces 19,319 cwts., Sukkur and Kurrachee 40,385, Bikaneer 3,600, and Afghanistan 4,896 cwts.

The total number of looms at work in the province during the year 1881-82 amounted to 136,733, as compared with 104,365 for the year previous, the increase chiefly occurring in the districts of Umballa, Rohtuk, Montgomery, Gujrat, and Hazara.

EDITORIAL NOTES.

WE have to acknowledge the receipt from Messrs. Robert Kettle and Co., Glasgow, of a very interesting series of tables containing the prices, from month to month, of the more important kinds of cotton yarns from January 1871 till December 1882—an eventful period of twelve years.

The most notable feature, it seems, in the prices of last year was the sudden and important rise in certain classes of yarns, owing to the war in Egypt, and the consequent diminution and deterioration of the cotton crop in that country. No doubt, these prices have since fallen to a point not much above the old rates, but it would be unwise to assume that all danger of another advance has passed away. On the contrary, when we consider that the poverty-stricken planters on the delta of the Nile are hurrying every bale into the market to raise money, and that April may witness the exhaustion of the crop, the long interval that must elapse before another can be grown may again afford a favourable opportunity to speculators to force up the price of Egyptian cotton.

ONE of the most remarkable events of the past year, connected with the Glasgow cotton trade, was the pitched battle fought between the Scotch Turkey red dyers and printers and the German alizarine makers. The Germans suddenly advanced the price of alizarine fifty per cent, and threatened, so it was understood, to stop supplies of alizarine, if the dyers did not give large orders at the new and exorbitant rate. Thus seized by the throat in a thoroughly Bismarckian style, our friends, the dyers, showed themselves to be quite equal to the emergency. They met the tactics of the Germans with the strategy of the hedgehog, and, by contracting themselves to half their usual bulk, they slipped cleverly out of the grasp of their Teutonic assailants. In other words, they cut down their consumption of cloth and yarn by something like 60,000lb. per day, reducing in proportion their demand for alizarine, and thereby gaining a decided victory over the manufacturers of that article.

ABOUT ten years ago the source of the Turkey red dye was either the madder root, or its product, garancine. Had any one at that time predicted that in a few years the garancine

trade would collapse, and the madder root be superseded by a chemical product, he would have been looked upon as unworthy of serious attention. Had the same prophet foretold that the waste products of gas-making, which gas directors were glad to pay the neighbouring farmer a good price for carting away and depositing on some moorland corner, would soon become one of the chief sources of revenue to the companies, his second prediction would have been looked upon by practical men as simply absurd and too good to be true. And yet both predictions have been amply fulfilled. Coal tar is now a great, and in some cases the chief, source of income to the Gas Companies, while its product, alizarine, is incomparably the most valuable and reliable raw material for Turkey red the dyers ever possessed.

Messrs. Kettle in their circular say:—The past two or three years have not been very profitable for the great majority of producers in the cotton trade. Although the volume of business has been large enough to keep machinery going, it has not been sufficiently large to enable spinners and manufacturers to get fairly remunerative prices. The prohibitive tariff of the United States, the gradual increase of duties on imports in France, Germany, Austria, Russia, and Spain—are all so many deliberate attacks on our commerce and manufactures. A confederacy, composed of nearly all the civilised nations and of our own most important colonies, has been formed against us, and the Government of 200 millions of the largest consumers in the world are doing what they can to shut out the produce of our looms and spindles. The most important problem of the day is, How and where are we to secure compensation for this constant loss of business? How and where are we to find customers to take the places of those who are leaving us?

The first great field for the extension of our trade and commerce, says Messrs. Kettle & Co., undoubtedly is India. True, we have almost a monopoly of her trade, but that trade is capable of an expansion far beyond anything hitherto accomplished. In 1875-6 the total imports of merchandise into India amounted to 37 millions, while in the year 1880-81 these had increased to 50 millions, about seven-eighths of this sum being from the United Kingdom and her Colonies. But 50 millions sterling is only about 4*s.* 2*d.* per head of the population,—not quite a penny per head per week from our Indian fellow-subjects. The imports into the United Kingdom amount to fully £12 per head, and if the Indian people could only be brought up to a twentieth part of this rate, or to import a shilling's worth for every pound's worth imported here, the result would be that India would consume thrice as much as she does at present, and we all know that a trebled demand for the East means a flourishing trade for the mills and the factories, the dye-works and the print-works of Lanarkshire and Lancashire.

Robert Kettle and Co., of Glasgow, in an interesting circular regarding the progress and prospects of the cotton trade, says:—

"Sir James Bain, who has devoted some time and attention to India, and whose opinion carries great weight, has arrived at the conclusion that, with India properly handled, we may safely defy Europe and America combined, and in spite of all their tariffs, successfully maintain and increase our mercantile and manufacturing supremacy. But Sir James goes further. He proposes to lead India into the great agricultural arena of the nations, there to compete for the highest prizes with all comers, and to wrest from the grasp of the American farmer the cereal championship of the world. Sir James calculates that if the present irrigation and railway facilities of India, which are inadequate and trifling compared with her dense population and boundless agricultural resources, were made abundant and ample, she could pay the freight from her own shores to Liverpool and thence to the sea-board cities of the States, where with her wheat, her Indian corn, and her millet, she could undersell the western farmer and realise a handsome profit for herself. Such a blow, vigorously dealt to the United States, up to the neck in protection, would be the grandest free-trade triumph of this generation. What an instructive spectacle it would be to see the American farmer imploring Congress to protect him from the invasion of his Indian rival. Meantime India, taking her proper position as the greatest agricultural and food-producing country in the world, would become rich and prosperous, and ten times more valuable to us as a buyer of merchandise than ever she has been. The apathetic indifference of the commercial and manufacturing classes to India is no doubt due to their ignorance of the real character and capabilities of that great country, and to their consequent inability to appreciate the enormously valuable services she can render to us, in return for equally important services rendered to her. She is especially and peculiarly an agricultural country, and therefore is exactly what we require as the complement to our manufacturing industries at home. Had her urban population been in the same proportion as ours, her towns and cities would have contained eighty millions of inhabitants, a population larger than that of all the Russias. Now, what is the fact? Her greatest city, Calcutta, is only about 100,000 larger than Glasgow; her second city, Bombay, about 30,000 less than Glasgow; while her third city, Madras, and her fourth city, Lucknow, require to be added together to be equal to the queen of the Clyde. These four cities, with all the other important cites of India added together, do not contain so many inhabitants as London. The people of India are to be found, not in cities and towns, but settled on the land; and it is computed that nearly 97 per cent. of the population depend more or less directly on the produce of the soil. But that produce, however cheaply grown, is of no value to the Indian farmer unless he can find a market for it, and no market can be found without railways. Sir James Bain says that within a few hundred miles of Calcutta, grain is offered at fabulously low prices without finding a sale, simply because there is at present no suitable means of transit to the great consuming markets. Now, suppose we were to begin in 1884 to make 2,000 miles of railway in India under Government guarantee, and to continue the process for five years to come, what would be the result? In the first place, we should send out to India about 500,000 tons of railway material annually; in the next place, the railway extension would bring every year additional millions of Indian cultivators into profitable connection with the markets of the world; and the outcome of the five years' programme would be that India would thrive as she has never thriven before; that she would become by far and away our best customer; and that the energies of the shipping, the manufacturing, and the iron industries would be taxed to the uttermost to meet the legitimate and growing demands of our Eastern Empire."

We observe with much satisfaction that the mining enterprise of Mr. W. O. Law, of Moulmein, in the Salween district, has succeeded beyond expectation. A correspondent writes:—"We shall have between two and three thousand tons by the beginning of the rains. The want of this country is roads and population. The Salween district, where the mines are, is a dense jungle, trees, nothing but trees, for days and days, miles and miles, trees *where men ought to be*, and this all because there are no roads and the waterways are so bad. The enormous fortunes in minerals and woods here exceed belief, could one only get at the places; but the forests are all wrapped in the silence of perpetual desolation, that is, as far as *men* are concerned, with here and there only a few miserable Karens in villages of 8 or 10 huts."

The outlook for those interested in the rice trade of Burmah is not particularly bright. Most millers have lost enormously by their operations this season. At the commencement, judging from home prices, low rates were looked for here, and an attempted co-operation amongst buyers to keep down prices was started, but owing to the state of commercial morality did not last 48 hours. The Burmese cultivators in the district withheld supplies, and in consequence prices of paddy have gone up from Rs. 70 to Rs. 95, leaving an enormous loss on contracts for delivery of rice entered into, taking the former rate as the standard price. I am told that in the district people hold large stocks of their own, and bought paddy which did not cost Rs. 60, and for which they now refuse Rs. 80. I am

afraid that this Burman tendency of not being satisfied with a good profit when available, will result in great loss to many holders who seldom make good arrangements for storing for any length of time. When the rains set in, towards the end of May, it will be found that much of the stored grain has been placed on low ground, where it is sure to get damp and heated, and will then be useless. And thus much of it, which could be sold profitably now, to yield at least Rs. 90 per hundred bushels, will be unsaleable except at a loss three months hence, if indeed it is saleable at all. In Rangoon itself, some mill owners are reported to have lost from 2 to 3 lakhs of rupees on their contracts this season, whilst, owing to the non-arrival of grain from the districts, many vessels have come on demurrage, occasioning great loss to their charterers. The outlook is indeed a gloomy one, and both buyers and sellers have themselves to blame. The former were foolish in trying to work together to reduce rates, and then in some instances cheating each other by allowing their brokers to pay extra rates, or to permit the baneful system of short measurements, for which the Rangoon paddy trade has acquired an unenviable notoriety. The sellers again, when they found they had the best of the bargain, and could realise a handsome profit, are foolish in holding on simply with the faint prospect of making those profits larger. They may find that they are killing the goose for the sake of the eggs, and that by their action they have so disorganised the rice trade that they may end in diminishing the number of future buyers, and thus reducing competition for their produce, whilst their arrangements for a "corner in rice" are of such a primitive nature in the districts that I fear it will be found eventually that many thousand tons of the 1883 crop will become damaged and unsaleable owing to bad storage, and thus a large quantity of food will go to waste, and the rest of the world be deprived of it through buyers and sellers in Burmah being unable to conduct their business on amicable terms.

Mr. John Algernon Clarke, the Secretary of the Institute of Agriculture, recently founded in South Kensington, London, calls the attention of farmers' sons and daughter to the advantages provided by the institute. Could the Government of India derive no hint from such an institution? Mr. Clarke says :—Our technical lectures, illustrated by diagrams, models, specimens, and apparatus, on poultry management, dairy management, and bee management, are so arranged that two lectures daily enable the whole course on each subject to be compressed into twelve days, while to attend all three courses requires a visit to London of under six weeks. Thus the advantage of almost a whole college term is afforded in a very brief period of practical instruction. The fee for each course of twenty lectures is only one guinea, or three guineas for all three subjects. A ladies' committee will aid female students in the selection of suitable lodgings.

The instruction in poultry management is given by Mr. W. B. Tegetmeier, F.Z.S., from March 28 to April 6, with an examination on April 7 for certificates of merit; the instruction in dairy management is given by Professor J. P. Sheldon and other experts from April 9 to April 20, with examination on April 14 and 21; and the instruction in bee management is given by Mr. F. Cheshire from April 23 to May 4, with an examination on May 5 for certificates of merit. The lectures are given at half-past ten and at noon in the morning of each day, in the lecture theatre of the South Kensington Museum. Simultaneously a series of eight evening lectures is arranged for guinea subscribers and their friends, while special arrangements are made for the admission of school teachers. I shall be happy to send full particulars to any of your readers who may apply to me.

The exports of grain from South Australia last year amounted in value to 4,187,840*l.* against 3,643,402*l.* in the previous year, The combined import and export trade was 12,067,000*l.* against 9,632,000*l.* in 1881. The wine exports have increased from 20,000 gals. in 1880 to 55,000 gals. in 1882.

The Provincial and Dominion Grangers have been holding their annual meetings in Toronto. This order, which is purely agricultural, and in fact is not open to any but *bona fide* farmers, has made great strides during the ten years of its existence. There are now in the Dominion 862 Grangers organised into fifty-five divisions. These societies appear to be doing a good work in promoting a desire for mutual improvement among farmers, and bringing many important questions to the front which could only be taken up in this way. It appears that seven-tenths of the inhabitants of the Dominion belong to the farming class; and the desire for further representation in both branches of the legislation was expressed by several speakers. Scientific farming is reported as having come much into vogue of late years, and is traced to the beneficial effect of these country Grangers. Altogether the order is in a flourishing condition, and seems to be doing a good work.

The following is from the *Colonies and India* :—Among the thousands of emigrants who annually leave our shores to carve out for themselves new homes in the backwoods of our various colonies, there must be a considerable number who at some time or other have cause to regret the incautious use of the axe or other tools, whereby wounds are unintentionally inflicted when far from medical aid. Under such circumstances the knowledge of some simple, cheap, yet efficacious styptic might save many a life, or at least hasten a tardy convalescence. In John Tradescant's garden at Lambeth, during the days of Charles I, there flourished one plant whose merits and uses, if then known, seem speedily to have been forgotten. But this plant, *Tradescantia erecta*, a native of Mexico, although possessing nothing attractive in either shape or colour, deserves to be inscribed in every emigrant's note-book on account of its extraordinary efficiency in arresting the flow of blood from wounds. When Mexico was visited by a French army some years ago, a native suggested that the commanding officer, General Martroy, should store in his camp a supply of what he described as "the blood-staunching weed," which proved to be the same plant to which the English king's gardener in 1629 gave his name. On his return to France, the General, having brought some specimens with him, planted and cultivated them at Versailles, and enjoyed the satisfaction of finding the plant taking kindly to the soil, and retaining all the original styptic properties attributed to it by the enthusiastic Mexican peasant. Indeed, its power of suspending hæmorrhage, on being crushed or chewed and applied to a wound, is said to surpass every hitherto known means. The Vienna press has lately been strongly advocating its regular cultivation, and the suggestion might well be adopted in other countries. The plant is easily cultivated, and would no doubt thrive in both our tropical and our temperate colonies.

Six years ago last July, S. J. Arnold & Bro., in the famous Nueces canyon, commenced with 875 goats and 1,400 head of sheep. Now they have 4,000 of the former and 8,000 of the latter. Their losses in sheep will amount to about the same in money value as their purchases, while on the goat question they are $2,000 ahead of their losses, besides their increase. During this period their losses from disease and otherwise have not been over two per cent on their goats. They have run seven different flocks which give steady employment to seven herders, besides a viciero (who superintends flocks), as well as extra hands to attend to other work on the ranch. In the shearing, lambing, and dipping seasons of course the number is greatly augmented. On this ranch the goats have been improved up by the best of thoroughbred billies until now the grades run from one-half to fifteen-sixteenths. Last spring their goat clip amounted to 1,200 pounds, which was sold in New York at an average of 40 cents. In common goats the profit lies in the hides and tallow, which always command a good price, and the supply of good meat in a shape that will not spoil in warm weather before it can be used up. By using Angora sires a flock can be graded up so high that the wool is more profitable than that of sheep, and the animal itself is hardier, more prolific, and less expensive.—*Uvalde Hesperian.*

According to the *Moniteur des Fils et Tissus*, a report on flax has been sent to the French Government by its Consul at New York, from which it would seem that the cultivation of flax (which was almost unknown in the United States at the commencement of the present century) has of late years acquired a certain importance. There are now more than a million acres devoted to flax-growing in various parts of the Union, Iowa occupying the leading position with about 300,000 acres, Indiana following with about 200,000, while Illinois and Kansas each furnish about 160,000 to the total. Ohio, Minnesota, Wisconsin, Missouri, and Nebraska show a joint total of about 320,000 acres. From this extent of land under cultivation, it would at first sight seem that the production of flax is sufficient to meet the domestic requirements of the Union; but it is remarked that the inexperience of the growers, and the inferior quality of the seeds used, have combined to limit the advantages which might be derived from this abundant culture. An authority on the subject has stated that farmers owning 450,000 acres are obliged, for the want of suitable outlets for the fibre, to burn it, and only to preserve the seed. The protection afforded by the tariff to the domestic industry has to be considered; and it is further asserted that two large Irish firms, who have recently established factories in New Jersey, are obliged to import the bulk of their requirements of the raw material.

The cause of this state of things has been attributed to the low price to which native American flax was driven, when the reduction of the jute tariff opened the American markets to large imports of the Indian fibre. The indigenous article would seem to have been employed at one time rather extensively in the manufacture of bags and of coarse tissues. The circumstances alluded to brought about a depreciation of value, which has discouraged farmers from giving the needful attention to the much-needed improvement of flax culture.

It is suggested that if a proportion of the immigrants now arriving on the shores of America were to be put it in the way of growing flax instead of wheat, &c., there would be more chances of success for those who have already been giving their attention to cereals. In this way, it is remarked, an improved quality of flax might readily be acclimatised in the Union, and, under the climatic advantages it enjoys, the New World might be reasonably expected to produce those supplies which have now to be imported.

At a recent meeting of the State Fair held at Utica, New York, Dr. Sturtevant, Director of the State Experimental Station, propounded a novel method of cutting seed potatoes for planting. He remarked that when a potato is planted in its natural condition, only two, three, or very rarely four of the eyes vegetate. He maintained with elaborate illustration of argument, based on experiment in germinating potato tubers, that a single eye has the capacity of originating all the potatoes that a whole plant ought to be expected to bear. He stated that the first absorption which takes place in the planted tuber is within definite lines, which lines may be distinctly seen by uplifting the potato, and soaking it in carmine water, when it will be seen that a line of vital tissue runs through the centre, with a branch running to each eye. Tubers may form anywhere on these lines, as the life of the potato is not confined to the eyes, for a whole potato, after the eyes have all been destroyed, will sometimes develope a new one inside the old one, without any outward vegetation whatever. His instructions for planting are—Cut out each eye deep to the centre of the potato at a certain definite angle, to be ascertained by experiment with carmine water—doubtless other colouring matter, such as most of the aniline dyes, will do as well—and you will get the maximum yield and the best quality of produce from that eye. Trials of this plan have been made at the State Experimental Station, of which Dr. Sturtevant is the director, with the following results:—A hundred hills were planted in rows a foot apart. Where whole potatoes, or halves, or quarters were planted, there was no sort of uniformity in the yield, whilst the crops of adjoining hills varied as much as three to one. Where single eyes were planted out according to the new method, so as to preserve the axis of the eye, the product was surprisingly uniform in all the rows. In every case a piece cut deep, however small the portion may be, gave a better yield and quality than when a large piece was cut shallow. He maintains that by cutting potatoes in the manner described, the yield may be increased at least 25 per cent., whilst a great saving is effected in the quantity of seed potatoes required to plant the allotted ground.

The great money crop of Western North America is stated to be Indian-corn.

Among our selections will be found a paper by Professor W. A. Henry on planting and cultivating northern cane. While some of the suggestions may be unsuitable for India, others, we hope, may be valuable.

The following analysis from *The Colonies and India* of the Export Trade of Britain is compiled from the monthly account published by the Board of Trade relating to the United Kingdom during February 1883. It exhibits, in as clear and full a manner as circumstances will permit, not only who are Britain's best customers, but the character of the business transacted with them. It is hoped that by this means our readers will be put in possession of information as to the course of trade in its different branches that will prove of some practical service:—

Principal Articles of Export.	The Continent of Europe.	The United States.	British North America.	South and Central America, including Brazil, Argentine Republic, Paraguay, Uruguay, Chili, Peru, Mexico.	British India, Straits Settlements, and Ceylon.
	£	£	£	£	£
Alkali	27,602	83,289	..	..	..
Apparel and slops ..	7,038	2,187	18,589	..	8,355
Bags, sacks, and packing cases	22,077	12,612	—	..	..
Beer and ale	..	12,558	—	..	27,498
Books, paper for writing and printing purposes, stationery, &c.	..	9,018	—	..	17,825
Carpets (not being rugs) ..	22,790	17,363	28,103	8,610	..
Coal, coke, cinders, and fuel manufactured ..	225,741	..	..	18,098	78,195
Copper, unwrought and manufactured ..	112,654	..	..	..	56,222
Cotton, yarn and twist ..	682,787	..	..	..	185,212
Cotton manufactures, piece goods of all kinds ..	781,113	157,968	..	538,799	1,341,760
Haberdashery, millinery, &c.	4,785	52,887	114,598	954	19,488
Earthenware	10,920	82,425	4,971	14,280	8,984
Hardware and cutlery ..	42,380	28,024	12,556	29,322	27,598
Iron and steel: pig, bar, bolt, angle, and rod iron, rails of all sorts; wire, galvanised or not; hoops, sheets, boiler and armour plates, fire plates (cast or wrought), galvanised sheets, tin plates and sheets, and all other manufactures; old, for re-manufacture, steel, unwrought, &c.	299,497	446,828	55,245	61,834	219,901
Lead: pig, rolled, sheet, piping, and tubing ..	8,849	1,518	..	..	6,367
Leather: boots and shoes	..	..	..	..	..
Linen and jute yarn ..	83,407	4,058	..	..	..
Linen manufactures ..	52,195	290,891	20,149	17,477	7,367
Jute manufactures ..	49,859	75,277	..	20,561	..
Machinery and millwork, steam engines, &c. ..	354,962	48,401	..	30,094	131,765
Oil: seed oil	114,749	..	8,172	4,029	..
Saddlery and harness ..	..	..	..	..	2,949
Silk: thrown, twist and yarn; silk manufactures, handkerchiefs, scarves and shawls, ribbons of all kinds, &c.	99,838	29,851	18,909	..	23,554
Spirits	727	2,881	2,958	..	..
Sugar: refined and candy	48,720	—	[illegible],926	..	..
Wool: woollen and worsted yarn, ditto manufactures, worsted fabrics and stuffs, &c.	791,685	322,243	140,516	67,448	20,891
Totals ..	3,790,725	1,668,914	421,689	823,242	2,271,851

Principal Articles of Export.	Egypt, China, Japan, Dutch East Indies, Philippine Islands, &c.	Australia, Tasmania, New Zealand, Fiji, &c.	British Possessions in South Africa and on the West Coast.	British and Foreign Possessions in the West Indies.	Other Countries.
	£	£	£	£	£
Alkali	..	..	..	..	34,093
Apparel and slops ..	..	135,130	64,750	8,110	21,361
Bags, sacks, and packing cases	..	5,017	..	..	43,207
Beer and ale	..	36,888	18,075	9,637	48,553
Books, paper for writing and printing purposes, stationery, &c.	..	50,180	..	..	182,215
Carpets (not being rugs) ..	51,818	18,186	..	..	28,009
Coal, coke, cinders, and fuel manufactured ..	..	..	..	..	178,000
Copper, unwrought and manufactured ..	6,290	..	..	..	32,074
Cotton, yarn and twist ..	105,702	..	..	..	77,020
Cotton manufactures, piece goods of all kinds ..	670,360	96,180	129,470	117,075	305,534
Haberdashery, millinery, &c.	..	65,742	26,012	15,566	50,711
Earthenware	..	28,248	..	..	35,482
Hardware and cutlery ..	..	67,557	10,410	8,571	98,215
Iron and steel: pig, bar, bolt, angle, and rod iron, rails of all sorts; wire, galvanised or not; hoops, sheets, boiler and armour plates, fire plates (cast or wrought); galvanised sheets, tin plates and sheets, and all other manufactures: old, for re-manufacture; steel, unwrought, &c.	30	251,959	53,291	..	504,208
Lead: pig, rolled, sheet, piping, and tubing ..	13,788	5,720	..	..	11,014
Leather: boots and shoes	..	62,101	35,923	..	45,394
Linen and jute yarn ..	..	..	..	..	8,271
Linen manufactures ..	..	23,441	..	34,289	81,753
Jute manufactures ..	8,411	..	..	..	34,260
Machinery and millwork, steam engines, &c.	..	115,936	..	..	180,927
Oil: seed oil	..	7,748	..	..	19,228
Saddlery and harness ..	15,621	..	4,188	..	9,902
Silk: thrown, twist and yarn; silk manufactures, handkerchiefs, scarves and shawls, ribbons of all kinds, &c.	..	24,184	..	..	70,008
Spirits	..	30,477	2,751	..	19,308
Sugar: refined and candy	..	..	..	..	52,084
Wool: woollen and worsted yarn, ditto manufactures, worsted fabrics and stuffs, &c.	71,055	78,437	..	..	177,814
TOTALS	901,488	1,098,087	340,770	193,248	2,216,197

Many of the entries of exported articles are rendered in these accounts in terms so general that it is impossible to include them in the above tabulated statement. The more important of such entries are set down as follows:—Animals, 21,755*l.*; arms, ammunition, and military stores, 104,235*l*; manufactures of brass, 37,606*l.*; candles, 10,270*l.*; butter and cheese, 14,713*l.*; manufactures of india-rubber, 84,278*l.*; carriages of all kinds, 70,413*l.*; chemical products, 149,357*l.*; lace and patent net, 321,158*l.*; hosiery (cotton) of all kinds, 106,019*l*; thread for sewing and stitching, &c., 160,717*l.*; fish, 5,933*l.*; glass—plate, mirrors, flint, bottles, &c., 75,022*l.*; hats of all kinds, 96,190*l.*; leather, unwrought, 115,096*l.*; pickles, vinegar, sauces, condiments, confectionery, &c., 90,278*l.*; plate and plated and gilt wares, 18,461*l.*; salt, 31,180*l.*; soap, 37,809*l.*; telegraphic wires and apparatus connected therewith, 22,738*l.*; tin, unwrought, 37,777*l.*; flannels and blankets, 95,658*l.*; and hosiery of wool and small woollen wares, 98,982*l.*

The enumerated articles represent a value of 16,470,210*l.*, in addition to which there are articles set down under the head "unenumerated" valued at 1,810,600*l.* The total declared value of British and Irish produce exported during the month of February last is 18,280,810*l.* The figures for the corresponding period last year were 18,935,994*l.*; while for February 1881, they stood at 16,835,550*l.* The toal declared value of exported articles during the two months ended February 28th last amounts to 38,889,469*l.*, whereas the returns for 1882 were 38,756,677*l.*, and for 1881, 34,154,461*l.*

THE following agricultural statistics from a paper read before the Society of Arts by Mr. Delisle Hay may be useful:—

Last year—1882—there were in the colony of New Zealand 3,638,069 acres under sown and cultivated grass; 1,002,485 acres under various crops; of which 365,715 acres were under wheat, 304,818 acres under oats, and 29,808 acres under barley. You thus see what a very small proportion (about 1-12th) of even the first-class agricultural land has yet been brought under crop. There is an impression prevailing in England that New Zealand is getting crowded, as far as the farm lands are concerned, and that not much is left available to agriculturists. No doubt it has arisen from the fact that the Crown lands in the South Island are mostly disposed of. But this is not to be taken as implying that you cannot now buy land there; you can certainly do so; but you buy from private owners, and, of course, at an advance upon former prices. Nor does it imply that the land disposed of by the Government has all been settled, and taken up. This is far from being the case, putting aside the question of the wide tracts leased as cattle-runs and sheep-walks.

I am desirous of proving to you, said Mr. Hay, the enormous capability of New Zealand as a wheat-raising country, and the possibilities of the future in regard to this item. The industry is yet in its veriest infancy, but enough has been done to show what may, and will be, accomplished in coming years. From the returns of last autumn—that is, February 1882—I quoted 365,715 acres as being the total area in the colony under wheat crops. The yield was 1,037,236 quarters, giving an average of rather more than 22 bushels per acre. The previous year, New Zealand had exported 670,157 quarters of wheat, value £745,729, nearly the whole of this being sent to Great Britain.

The New Zealand farmer has already begun to enter into competition with his fellow of Manitoba and the prairie lands of North America, in supplying us here with corn, though what he has so far done be only an index of what he will eventually accomplish. 365,715 acres under wheat has served for a foundation to the grain trade: but this extent is only a tithe of the 12,000,000 acres—at least—which are suited for the corn-raiser. It is profitable now to the New Zealand cultivator to send his produce to Great Britain, in spite of present disadvantages. But when transit across Panama is rendered feasible, the cost of placing wheat on the London market should be lessened from the 1*s.* 8*d.* per bushel at which it stands at present, and the profits of the grower will be consequently greater.

Corn-raising in New Zealand must be considerably more advantageous than in North America. The virgin soil of the colony returns an average crop of twenty-two bushels per acre, about double the average of the prairies. An average of thirty to forty bushels has been reaped in some districts, and ninety bushels of oats has been known. Then, having no severe winter to contend against, the New Zealand farmer can generally utilise his land for a second crop of roots or other produce, and can also make use of straw. His crop is also far heavier than what is raised in Australia, where, moreover, droughts often render wheat a failure. He has a home market, and an Australian market, besides an English one.

It is in the south-eastern part of the South Island that most farming has yet been done. By far the greatest part of the land now in cultivation is located here, and the production of other districts has been slight, as compared with the production of this. This applies to the present only, though, for the North Island, and the northern section of the South as well, will show substantial returns by-and-bye.

Agriculture is being more and more largely resorted to in all the counties of the south-east section, grain and other crops being raised in all. But the chief wheat-growing counties as yet are Ashley, Selwyn, Ashburton, Geraldine, Waimate, Waitaki, and Southland. Still, in Waikouaiti, Taieri, Tuapeka, Bruce, Clutha, Lake, and Wallace, agriculture is promising, and large harvests of corn will yet be reaped in them also. The stockman and shepherd are here giving way to the steam-plough, just as the export of wool and tallow and hides is being encroached upon by the demands of local manufacturers.

The New Zealand of the future will be a country exporting her own manufactured goods rather than her raw produce. The beginnings of this are already evident, and, as we might expect, are chiefly apparent in the Otago and Canterbury districts. Take the item of wool, which, as you know, has been one of the main exports of the colony. In 1880 the quantity exported was 66,860,150lb., value £3,169,300. There was a

slight decrease the following year. But there are now four woollen factories at work, soon to be followed by others. The aggregate valuation of their plant is £100,000, about, and they employ 417 hands. The factory at Mosgiel, near Dunedin, is turning out tweeds that already have a considerable repute. In 1881 the profits of this establishment were £6,900, giving a ten per cent dividend to the shareholders. There is a reserve, too, of £10,000. At Roslyn, a suburb of Dunedin, there is another woollen factory, which cost £60,000, for buildings and machinery. In the rapidly rising town of Oamaru there is another. The fourth is at Kaiapoi, in Ashley county. This last has 1,440 spindles and 30 looms, and it is said that it can turn out 1,000 pairs of blankets, and 6,000 yards of flannel per week.

These figures may not seem very large, perhaps; but Manchester and Glasgow had small beginnings too, and the development of manufacturing centres in New Zealand will be more rapid, because of the increased facilities procurable in these latter days. Wool and woollen manufactures have the most important bearing on the future country. It is doubtful if the wool-growing capacity of the colony has reached anything like its ultimate maximum. The great sheep-walks of natural pasture must certainly diminish year by year, as agriculture is more resorted to. On the contrary, land at present covered with useless fern and scrub, or with forest, annually yields a larger and larger area to the settler, which is broken up and put under grass—made into meadows and paddocks, in short; and this will feed more sheep to the acre than the other; so that the flocks may be even increased in number, although the present pastures be more encroached on by the plough.

CONSUL MCLAIN states that, next to the pine-apple business, the trade in sponges is the most important industry of the Bahamas, bringing considerable gain to the colony, and furnishing steady and lucrative employment to several hundred vessels and several thousand persons. At first sponges were divided into only two classes—the coarse and the fine, the former realising about twenty-two shillings a hundredweight, and the latter about double that sum. They are now, however, divided into many varieties, among the best known being, "sheep wool," "white reef," "abaco velvet," "dark reef," "boat," "hardhead," "grass," "yellow," and "glove." The vessels engaged in sponging are small craft, of an average burthen of ten tons, each vessel carrying from six to twelve men. They are furnished with about six weeks' provisions, and coast along the banks and reefs where the water is shallow, and among the islands where the sponge is known to exist. The sponges are seen growing upon the rocks, reefs, and shallows, the water being particularly clear, and they are brought to the surface by means of iron hooks, fastened to long poles, or by diving. When first taken up, they are found to be covered with a soft gelatinous substance, full of life, and perfectly black, the sponge proper being but the skeleton or support of this living organism. The day's catch is spread upon the deck so as to kill this living covering which, in decaying, emits a very disagreeable smell.

When a sufficient quantity of sponge has been gathered, the boats are taken in shore, and a pen or hut of stakes is made on the beach, at the water's edge; the sponges are placed inside, when the action of the tide helps to remove the black covering, the process being completed by pounding them with sticks. Having been cleansed in this manner the sponges are strung upon small palmetto strips, each string containing three or four sponges, being called "bead," and with this cargo the vessel returns to Nassau. A cargo will vary from £15 to £16, according to quantity, quality, and demand. The sales and handling of the sponges are controlled by the Nassau Sponge Exchange Company, an organisation holding a charter from the Colonial Legislature. The company has erected a commodious building upon one of the wharfs; and it is in this building that all the sponges are sold, subject to certain taxes and restrictions. As soon as the daily sale is concluded, the sponges are taken away to the packing yards, where they are assorted and clipped into good shape. They are then put into tubs or vats of lime-water to soak for several hours, and are afterwards spread upon canvas to bleach and dry in the sun.

They are next pressed by machinery into bales about three feet by two feet in size, each containing 100lb., the packages being covered with coarse bagging, securely sewed and corded, and are then ready for shipment. All the work in connection with the sponges, from the taking to the shipment, is performed by the blacks. There has recently been discovered, Consul McLain says, a new and extensive field of sponges near the island of Eleuthera, only sixty miles distant from Nassau; the water, however, on this new field is from five to eight fathoms in depth, and this has the effect of rendering the gathering of the sponges tedious and laborious. It is thought that the field is a very extensive one, stretching over many miles, and that the sponges are, as far as known, all of the "sheep wool," or most valuable description. The majority of the sponges found up to this time are of a very large size, and will not bear cutting to advantage, as the inner portions appear to be very tender.

During three months of 1882, this field was actively worked, but a sudden interruption has occurred, caused by the fact that myriads of small fish have invaded the grassy bottom, stirring up the mud to such a degree that it prevented the sponge from being seen. It is the opinion of fishermen who have been engaged for years in this industry in the Bahamas, that the sponges can only be gathered in any quantities in this field during a portion of the year when the water is still and the fish is absent. This would detract very considerably from the value of the discovery. It appears from statistical returns of the imports and exports of the Bahamas that there is a very large increase in the annual exports of sponges, the value in 1881 amounting to about £38,000, or nearly twice as much as in 1874.—*Journal of Society of Arts.*

MR. L. GISBORNE SMITH, in the *Indian Forester* for April, has the following:—"I notice in your vol. IX of January 1881, an article by Mr. Gamble, containing a list of tea-box woods used in Darjeeling. He concludes his letter by asking some one to furnish a list of the woods used in Assam and Cachar. As the tea industry is not confined to Bengal and Assam alone, I would suggest a general list being compiled of all the woods used for making tea-boxes in various presidencies and provinces throughout India where it exists.

To further this suggestion, I send you a list of tea-box woods used by the planters of the Kangra district, Punjab—

PALAMPORE TEHSIL, KANGRA DISTRICT.

Chil	...	... *P. longifolia.*
Raj	...	... *A. Webbiana.*
Tos	...	... *A. Smithiana.*
Oi	...	... *Albizzia stipulata.*
Tun	...	... *C. toona.*
Mango	...	... *M. indica.*
Simmal	...	... *B. malabaricum.*

KULLU TEHSIL, KANGRA DISTRICT.

Kail	... *P. excelsa.*
Rai	... *A. Smithiana* (called *Tos* at Palampore).
Tos	... *A. Webbiana* (called *Rai* at Palampore.)

These are chiefly used, though there are several other woods which I have no doubt would answer the purpose, such as alder, elm, poplar (phalse), hill tún, and chil. Deodar is not used for tea boxes owing to its strong smell of turpentine.

I hope to see the general list added to.

I KNOW, says Mr. George W. Pascal, from practical experience that M. Bourlier and M. Hervé are quite correct as to the value of diseased potatoes as an article of food for cattle, pigs, &c., but the most important item to be observed they omit in their directions, which I revise as follows:—

Boil the diseased tubers fast till done; drain, and let them become perfectly dry by spreading them out on sieves—a gravel screen is the best. The tuber, when cooked, is free from poison; the water in which it is boiled is a very strong poison, and will scour, if not kill, any animal that partakes

of it. When dry, ram tight into any kind of dry cask (with salt), and keep in a cool place till wanted. One copperful can be dried and packed while the next is cooking, so that a large quantity can be cooked in one day. Every farmer should know this, as it would save him suffering any loss, however bad his crop might be.

It appears that the success of the Ahmednuggur horse and cattle show and agricultural exhibition held at Nagar in August last has exceeded all expectations. The results of the exhibition, so far as regards the horse show, have brought to notice the fact that many excellent mares are to be found in the district, and the Bombay Government is, therefore, of opinion that considerable improvement may be effected in a few years in the breed of horses through the services of the Government stallions. We observe that mule-breeding is also said to be making progress, and prizes were awarded at the exhibition to the owners of all mares proved to have been covered by donkey stallions. Some of the excellent bulls exhibited by the Khandesh farm were bought up at the exhibition, and it is believed that their purchase will lead to an improvement in the quality of the cattle of the district. The agricultural part of the exhibition, too, was very successful. Some samples of excellent wheat were brought from parts of the district, and it is trusted that the exhibition will have the effect of stimulating the production of the better classes of grains. In connection with the Ahmednuggur horse and cattle show, we observe that it has been decided to discontinue the horse show at Sirur, which is near both Poona and Ahmednuggur, at both of which places horse shows are held. This will have the effect of making the Sirur exhibitors bring their cattle over to either the Poona or Ahmednuggur shows.

In consequence of the early setting in of the rains, the *kharif* season of 1882-83 in the North-Western Provinces does not appear to have been very favorable for canal irrigation, although the area irrigated during that period was 739,410 acres, or 33,385 acres in excess of the area of the preceding year. The principal crops irrigated were sugarcane, rice, bajra, and juar, maize, fodder crops, fibres, and dyes. The increase of 33,385 acres occurs chiefly under sugarcane, maize, dyes, and miscellaneous crops. The total area of 739,410 acres was irrigated in the following proportion by the different canals of the provinces :—

	Acres.
Upper Ganges	335,570
Lower do.	199,115
Agra	52,263
Eastern Jumna	112,483
Rohilkhund	32,663
Dim	5,520
Bijnour	1,678
Hameerpore Lakes	70
Jhansie	42

Mr. W. Coldstream has written a very valuable note on the encouragement by Government of private efforts by zemindars in tree-planting in the Hoshiarpore district, which we give in its entirety :—

"Captain Montgomery's recommendation, that zemindars should be encouraged to plant on the edges of *chohs* or sandy torrents, I entirely agree with. Plantations in such situations would have the best effect, and an effort in this direction is the proper and necessary complement to reboisement operations in the hills now under consideration. The useful action of plantations in stopping the encroachment of *chohs* cannot be doubted; and it is a fortunate provision of nature that the *shishum* tree grows particularly well in the sandy soils of this district, and a plantation will spring up in most unfavourable-looking tracts in or near the beds of *chohs*.

"The value of a belt of trees or plantation in stopping sand drifts, or *urár ret*, as it is now generally termed, is obvious.

"I think Captain Montgomery's proposal as to terms is appropriate, but I would be inclined to limit the concession to the term of settlement, when the plantation is formed on land actually assessed to revenue.

"I think also that Captain Montgomery's proposal to except fruit-trees is proper; and I also agree that the rules should not have retrospective effect. I understand that Captain Montgomery proposes that when the land is unassessed, a remission of revenue on an area equal to half of that of the plantation should be allowed. I think this will be all that is needed. The plantations should be subject to supervision by the District Officer, who should have the power of cancelling the grant when the plantation was not properly looked after when young, when the trees were cut down too soon, or too many at once, or when trees cut down were not replaced by fresh saplings. And the grant should not be made till the District Officer is satisfied that the trees are not only on the ground, but in a fair way of doing well, and growing up into a plantation. This would ordinarily be in the second or third year after the trees were planted or sown.

"But there is another direction in which I think that village plantations should be encouraged, and much might be done by judicious encouragement at settlement.

"Captain Montgomery's proposal is specially aimed at defending village lands against *choh* action, and this is doubtless the direction in which Government has most to gain from village arboriculture. But I also think that village groves and plantations on a large scale might be beneficially encouraged without special regard to their utility as defences against the torrents. There are in this district, in the plains as well as in the hills, villages of enormous area, containing *shamilat* lands, generally no doubt of an inferior description of soil, but quite suitable for tree planting, and capable of bearing most valuable plantations of *shishum* and other trees; such as *ber*, *kikar*, *dhak* or palas (Butea frondosa), *burr* (Ficus indica), and others. There can be no doubt that many villages have tracts of land in excess of their grazing requirements, and that even if plantations prevented the growth of grass, they might have a much more remunerative product in trees. The grass on many of these *shamilat* lands is of exceedingly poor quality, such as it would hardly be a loss to abandon. But I believe that the growth of trees on many lands, if they were not planted so as to be crowded together, would not only not destroy, but improve, the grazing, and thus secure a double benefit to the village. It is quite unnecessary here to say anything about the value of trees to the villager in particular, or of large areas of plantation to the country in general. Villagers are now beginning, as mentioned by Captain Montgomery, to appreciate the benefits to themselves of tree planting, and many plantations of trees other than fruit trees are to be found throughout the district. But they want, I think, two helps. They need to learn, and have it constantly impressed on them, that trees will not grow properly unless the area in which they are planted is thoroughly fenced in, and for the first five or six years kept free of cattle and goats. Secondly—and here it is where I think a grand opportunity presents itself during settlement—they *need to be encouraged to combine, as proprietors, to rear communal plantations*. I believe that they know their own interest quite sufficiently to be willing and even eager to enter into a scheme of the kind if the Settlement Officer will be so kind as to show them the way. What they sadly lack is *capacity for corporate action*. This capacity, I conceive, could be developed and stimulated by a very little aid on the part of the Settlement Officer; and when the administration paper is drawn up, an excellent opportunity presents itself. They would, I am convinced, in many cases be most willing to set about making common plantations if, *first*, they were only shown the right way to set about it, and *secondly*, were assured and became convinced that Government had no wish to interfere with their rights in the land or trees to be raised on them.

"What I should propose is that when there is any large area of common land, the proprietors should be encouraged to enter conditions in the administration paper relative to

Fencing,
Planting or sowing,
Tending,
Protecting,
And in due time grazing in,
and cutting wood in, } A communal plantation or plantations.

"The rules need not be long, and might be very simple. Under present circumstances any proprietor, who was progressive enough and sufficiently public-spirited to propose making a common plantation, would encounter a hundred difficulties in the

apathy of some and the jealousy of others of his fellows. But if rules on these points were drawn up in council under the supervision and at the instance of an official of influence, the ice would be broken, and official sanction would afford the necessary stimulus in a direction to which they would feel that all their own interests tended."

An esteemed correspondent writes to us: "The Nagas in this portion of the Naga Hills (above Amgourie tea garden), are getting a good deal of rubber from a woody vine. The vine climbs trees and grows to three or four inches in diameter. When the seed-pods are ripe, they burst open, and a light flimsy material comes forth, and is wafted about by the winds. It is this fact that gives to the vine its Naga name *Apungmange*. The botanical name I do not know. The vine is common in the forest jungle of these hills, and the Nagas say it is in the forests at the base of the hills, but not as abundant as in the hill forests. The juice in the green state and when dried has every appearance of that from the rubber tree. It might be well for Government to ascertain how abundant this forest vine is in the plains and other hill districts of India: also to give a thorough test of the value of the rubber from this vine.

From the report on forest administration in Coorg for the year 1881-82, we learn that the total area of the reserved forests at the close of the year stood at 234 square miles, or 149,855 acres. There were no additions made to the area of the reserves during the year under notice. The work of demarcating the ghat forests was completed, and 63 miles of new line were opened up at a cost of Rs. 6 per mile. We observe that it is intended to depute a settlement officer to go over the line thus demarcated, with the object of settling any claims which the ryot may advance as to the inclusion in the demarcated area of portions of land belonging to private individuals.

The results of the attempt to protect the forests from fire during the year under notice do not appear to have been as successful as in previous years. Out of the total area of 123,049 acres which it was attempted to protect, only 46,556 acres were successfully conserved at a cost of Rs. 1,417; the failures amounted to 76,493 or 62·16 per cent of the so-called protected area. The fires appear, it is said, to have been caused by shikaris and kurumbars, and are attributed to a want of vigilance on the part of the forest guards. We observe that some difficulty has been felt in working the remote and inaccessible ghat forests, owing to the extensive timber thefts committed by license-holders, who felled much more wood than they were entitled to. To remedy this, it was determined to lease the forests to respectable contractors, but the results have not been satisfactory, as the contractor to whom the Urti and Kerti forest was leased, has failed to make it pay. The local administration, it appears, now propose to work the forests departmentally, and this is to be done at first on a small scale.

An area of 109½ acres was added during the year to the plantations already in existence, which measured in the previous year 327¾ acres. The planting operations generally are said not to have been very successful owing to scanty and unseasonable rainfall; while the rearing of teak in plantations is also reported to have been not very satisfactory, in consequence of defective methods adopted in sowing and planting. There were 21 cases of breach of forest rules prosecuted during the year, of which 14 cases resulted in convictions, and 31 persons were punished.

The financial results of the year are given as follows:—

	Rs.	A.	P.
Receipts	1,00,363	12	4
Charges	59,858	1	1
Surplus	40,505	11	3

Compared with the income of the foregoing year, the receipts have increased by Rs. 12,507, the excess being attributed to large sales of timber, and to heavy fines imposed on timber stealers. Only 60¾ tons of sandal-wood appear to have been sold during the year instead of 120 tons, the annual quantity fixed for sale. The decrease is due to the small quantity of sandal-wood sold, the authorities refusing to sell the remainder owing to the low rates offered. The merchants, it is reported, have combined to keep the rates down, and the small quantity of Coorg sandal for sale has of late failed to attract richer and more respectable merchants, especially as the neighbouring province of Mysore has been supplying much larger quantities of sandal to the market.

An American paper says:—The enormous amount of jute bagging used in the United States, and especially in the South, where it is required for covering six million bales of cotton annually, directs attention to this article as a staple of great importance and value to the people of this country.

Jute, as is well known, grows luxuriantly, and can be produced with little trouble and expense in the Gulf States, but the difficulty of preparing the staple for market has been the great obstacle in the way of its adoption as a Southern agricultural product. The jute of commerce is grown in India, and is there prepared for market by the cheap hand labour of the natives, and as a consequence the Southern planter, at the rate he is forced to hire labour, cannot grow and prepare the fibre so as to compete with the Asiatic producer. Attempts have been made to use mechanical contrivances for separating the fibre of the plant from the woody matter of the stalk, but heretofore no satisfactory results had been secured; but now a new machine for separating and preparing the jute fibre has come to public attention, and, as far as it has been tested, it appears to have accomplished the solution of a most important problem. Details of experiments with this machine are given in another column, in a letter from Col. Daniel Dennett. He presents an interesting account of the working of the machine at the Menelas plantation, near Brookhaven, Miss., on Friday, October 27th, when it was employed upon green jute stalks just as they were cut from the fields. The results given are said by Mr. Dennett and other gentlemen to be excellent. So effectually did the machine do its work, that Mr. Smith, the patentee, who was present to test its operations, declared that it would prepare jute fibre for market at a total cost for production and separation of 2 to 2½ cents per pound, when the imported article is selling in the markets of this country at 4 to 4½ cents a pound, an unusually low price by the way, but one nevertheless which will pay a handsome profit to the American producers.

With these results assured, another great industry is likely to be opened to the Southern planters, and vast areas of lands in Louisiana and other of the Southern States will be available for its development; but the matter will not stop with the production of jute. The ramie will follow logically. The need of machines that will properly and profitably effect the preparation of the ramie fibre, will doubtless be supplied as effectually as for the jute. The Whitney gin created the cotton industry. It remains for another genius to bring the jute and ramie fibres to a front rank in our textile productions. Let us hope this grand result is now about to be realised, and that other great industries are to be opened up to the rich lands of lower Louisiana and the whole Gulf coast.

The *New York Experiment Station Bulletin* has the following note on milk:—

There is much to be learned yet concerning milk. We know that milk is not a filtration, but is manufactured within each division of the udder, and is therefore variable, according to the working power of each separate factory. We know there is a difference, through analyses of the milk of each teat separately, as such analyses have shown a variation in physical constituents as well as of structure. We also note that what affects the efficiency of the factory, has also a perceptible effect upon the milk. It is this relation between the milk and the cow which causes the dairy cow to exist, and which enables us to say boldly that breed is superior to feed. On account of this structural relation of milk, its secretion becomes influenced by heredity, and the breeder is enabled to add up qualities through successive generations of selection, even as the book-keeper adds up his successive items in the column of his ledger, in order to obtain the total results. The heredity of the wild cow has not been selected in the direction of milk. The cow in a state of nature

yields milk, but in the presence of her calf. The dairy cow, however, the creation of the art of man through the process of selection, has had successive advances in milk-giving added on to each generation, until, unlike the wild cow, the dairy cow yields milk to man, irrespective of the presence of the calf to excite the flow. The wild cow may be fed on the most succulent and milk-promoting foods, and yet she gives no profit to the dairy-man. The dairy cow, however, responds to feed, in milk to a greater or less extent, according to the heredity of the milk secretion which she represents.

Under this condition, we should expect to find phenomenal occurrences in our individual cows, such as excessive yields of milk, of butter, or of cheese; yields promoted either by accidental circumstances, or else through what we must call the accidental accumulations of heredity in some special direction. Thus, in my past experience, I have known the milk of each teat of the same cow to vary from 24 to 42 per cent of cream, and one day the milk of a cow which usually only marked from 13 to 15 per cent of cream, gave distinct definition of 60 per cent of cream. Thus, some Jersey cows have yielded as much as three pounds of butter a day, or more; thus some cows have a record of rising 100 pounds of milk a day for several successive days.

FROM a recently issued circular of Messrs. Ohlendorff & Co., we quote the following :—

The one mineral element to which too little attention has been directed in practical agriculture is potash.

In most stiff soils there is sufficient available potash to support the drain of numerous crops, especially of crops whose roots penetrate some depth in search of food; on the other hand, in most shallow soils of a poor character, in moor lands, and old pasture lands, there is seldom a sufficiency of available potash for the proper development of the crops.

Carefully conducted experiments, notably those of the eminent French chemist, M. George Ville, has proved that a defective supply of potash is fatal to normal growth, even although the crop may have at its disposal plenty of nitrogen, phosphoric acid, and the other elements of plant food.

Some plants require for their harmonious development more potash than others, but all, without exception, require a certain quantity, and where the soil, though well dressed with nitrogen and phosphatic manures, produces disappointing crops, the most frequent cause is poverty of potash. Bearing in mind that the entire quantity of the mineral constituents in plants is only 1 to 3 per cent, about 95 per cent being carbon and water, derived from the air and rain, the following table, showing the approximate quantities of potash and phosphoric acid carried off by the principal crops, demonstrates in a practical manner the important part acted by potash in plant life :—

A crop of	contains in lb. per acre :	Potash.	Phosphoric Acid.
Wheat 5 qrs.	grain	9½	15½
	straw	29	11
	Total	38½	26½
Barley 5 qrs.	grain	11	15
	straw	19½	5
	Total	30½	20
Oats 6 qrs.	grain	9	13
	straw	24	4
	Total	33	17
Turnips 20 T.	bulbs	126	31
	tops	76	28
	Total	202	59
Potatoes 8 T.	tubers	68	18½
	haulms	9	3
	Total	77	21½
Hay (clover) 2 T		52	20
Beans 25 bush,	corn	23	24
	straw	89	12
	Total	112	36

It is not to be inferred from the table that the application of potash is more necessary than that of phosphoric acid, because deep soils contain as a rule naturally sufficient potash, and light soils usually a little, whereas almost all soils, both heavy and light, are deficient in phosphoric acid. The figures, however, prove that where there is not naturally sufficient potash, or where frequent cropping has too much exhausted the natural supply in the soil, it is essential to add this constituent.

Probably the best way of supplying potash is in the form of genuine *Stassfurt kainit*, which should contain a little over 23 per cent sulphate of potash, and equal to about 12½ per cent pure potash, and includes also a large proportion of magnesia and soda. The following is a complete analysis of *kainit* by Dr. Aug. Voelcker:—Water, 15·61; sulphate of potash, 23·93; sulphate of magnesia, 17·25; sulphate of lime, 0·95; chloride of magnesia, 14·54; chloride of soda, 27·27; insoluble matter, 0·45—total 100·00.

One cwt. of *kainit* contains just about 14 lb of pure potash, whereas it takes 28 cwt. of farmyard manure to provide the same quantity.

The best time to apply *kainit* is in the autumn or quite early in the year.

It is also found advantageous to occasionally spread a little *kainit* in stables, cattle-yards, and on manure heaps, as the ammonia in the manure is thereby partly fixed, whilst at the same time the percentage of potash and magnesia in the manure is increased.

THE following Resolution of the Government of the North-Western Provinces and Oudh, Public Works Department, Irrigation Branch, No. 6181 of 1883, dated the 3rd March 1883, exhibits concisely the work done :—

The kharif season of 1882-83 (from 1st April to 30th September 1882), was not very favourable for cane irrigation owing to the early setting in of the rains. In the beginning of June heavy rain fell in almost all districts, but the break in September caused a demand for water on the Eastern Jumna and Upper Ganges Canals.

2. The returns, however, show an increase of 33,385 in acreage and of Rs. 1,64,584 in assessments over the totals of last year. The total area irrigated during the season under review was 739,410 acres, or 7,825 acres more than the highest ever recorded, *viz.*, in 1877, a year of drought, when the irrigated area exceeded the highest previously attained by 229,960 acres.

The following statement shows in detail the areas of the principal crops irrigated during the last four years :—

TABLE I.

	1879.	1880.	1881.	1882.
	Acres.	Acres.	Acres.	Acres.
Sugarcane ...	165,661	135,292	164,569	197,978
Rice ...	75,903	135,570	101,755	96,357
Bajra and juar ..	6,635	43,266	4,141	5,104
Maize ...	17,265	89,274	22,376	33,411
Other food-grains ...	12,535	9,207	6,887	5,982
Fodder crops ...	5,996	7,924	4,554	9,930
Fibres ...	59,580	63,680	63,247	49,722
Dyes ...	185,195	194,983	319,992	316,872
Miscellaneous ...	26,871	20,948	18,504	24,354
Total ...	555,641	700,139	706,025	739,410

Sugarcane has far exceeded the area of last year, and the increase is fairly distributed over all divisions. Rice is slightly under the average of the last three years. The chief falling off is on the Rohilkhund Canals.

The increase in food-grains is due to the large area under maize, which cultivators were compelled to irrigate owing to the break in the rains in September. The increase in this crop alone is 11,000 acres.

3. The items given below exhibit the aggregate differences in the chief crops as compared with the previous year :—

	1881-82.	1882-83.
	Acres.	Acres.
Sugarcane	164,569	197,978
Food-grains	135,159	150,784
Dyes, fibres and others	406,297	390,648
Total ...	706,025	739,410

The rise in the acreage of sugarcane is alone equal to the total increase in the irrigated area on canals, whilst that in food-grains is counterbalanced by a decrease in dyes, &c. The falling off, however, in the latter is not due to any appreciable diminution of the area under indigo, the total under which is 316,903 acres against 319,040 acres last year.

4. Table II compares the irrigated areas of the two years 1881 and 1882, by canals :—

TABLE II.

Canals.	1881.	1882.	More.	Less.
	Acres.	Acres.	Acres.	Acres.
Upper Ganges ...	296,554	335,570	39,016	......
Lower Ganges ...	204,572	199,115	......	5,457
Agra ...	56,497	52,263	......	4,234
Eastern Jumna ...	104,197	112,483	8,286	......
Rohilkhund ...	35,922	32,663	......	3,259
Doon ...	5,315	5,520	205	......
Bijnour ...	2,894	1,678	......	1,216
Hamirpore Lakes ...	45	76	31	......
Jhansi ...	29	42	13	......
Total ...	706,025	739,410	47,551	14,166

The increase on the Upper Ganges Canal is in the four upper divisions, *viz.*, the Northern, Meerut, Anupshahur, and Bulundshahur, which, in round numbers, have extended their irrigation by 8,000, 17,000, 5,000, and 10,000 acres, respectively, over the figures of last year.

On the Lower Ganges Canal the falling off is entirely in the two old divisions, the Cawnpore and Etawah, owing to short supply in the river in the early part of the season. The new divisions taken by themselves show a slight increase, 74,800 acres against 66,527 ; and this might have been greater had there been more water available for the tail portions.

The principal crops in these new divisions compare as follows :—

Crops.	1880.	1881.	1882.
	Acres.	Acres.	Acres.
Sugarcane	2,739	6,652	9,415
Indigo	13,171	51,855	56,720
Cotton	1,220	250	80
Others	11,587	7,770	8,585
Total ...	28,717	66,527	74,800

This clearly shows that the tendency is for sugarcane and indigo to increase. Cotton apparently is unable to obtain a footing.

There is a slight falling off on the Agra Canal, the decrease being about equal to that in cotton alone. There is, however, an increase in sugarcane, but almost the same decrease in indigo.

On the Rohilkhund Canals there is a rise in sugarcane and a falling off in rice, and, on the whole, there is a slight decrease. This is due to there being no demand for water for late kharif rice sowings.

On the Eastern Jumna Canal the increase is due to sugarcane.

5. Table III shows the assessment on account of occupier's rate of the last four years :—

TABLE III.

	1879-80.	1880-81.	1881-82.	1882-83.
	Rs.	Rs.	Rs.	Rs.
Upper Ganges ...	12,01,470	9,09,785	9,69,853	11,01,884
Lower Ganges ...	31,072	4,15,906	4,92,948	5,11,884
Agra ...	69,478	98,055	1,68,898	1,57,621
Eastern Jumna ...	3,99,739	3,99,757	4,29,219	4,55,995
Rohilkhund ...	20,106	46,857	33,527	32,800
Doon ...	19,219	17,115	15,752	16,839
Bijnour ...	1,146	4,781	5,378	3,019
Bundelkhund ...	469	479	131	116
Total ...	17,42,699	18,92,735	21,15,706	22,80,290

The rate per acre is Rs. 3·08, and is therefore better than that of last year, which was slightly under Rs. 3. This is due to the increase in the better class of crops, notably sugarcane.

AL CULTIVATION.

(*Communicated.*)

[IN the following communication, which is from a native agriculturist, we have made no attempt to change the English of the writer.—ED., *I. A.*]

THIS crop is grown in almost all zillas of Berar. It is not heard that it is ever been made in the Deccan.

USES.

It is known as a root-crop. It also produces seed-grain just like that of mustard, with the only difference of its colour. Al seed is of the black colour. Oil of good medicinal character can be pressed from it, but no experiment has as yet been made to the effect. Roots of al make a deep red and rose colour. These roots are generally exported to England whence we get beautifully coloured stuffs of different sorts. These stuffs are sold very dear here. Whatever colour made from the roots is very deep. At some places in Berar, Ellichpore, Khamgam, Daryapore, &c., some traces of its colour manufactories are still seen. A greater portion of these roots is also exported from Berar to Chaterpore in Bengal where good mantles (*rajayas*), *kharwas* (red cloths used for making coverings to cushions) are dyed from its colours. These cloths are well known here as "Nagpore kharwas." The slenderer the roots, the better they are considered for making colours. These roots when large are called "kandas." The slender roots fetch a double price in bazaar. It is a matter of the greatest importance in its cultivation that it should not be allowed to feed larger.

CLIMATE.

As this crop is well-grown in Berar, it must be said that the Berar climate suits far better to it. The climate of Berar is, in general, hot. The average of rainfall here every year is little more than 30 inches. There is a very little difference, if it ever is, between the Berar and the Deccan climate excepting some districts. Much rain is considered detrimental to this crop. In the first year a inferior dual crop, either of jwari or castor-plant, is generally made with the al.

SOIL.

The agriculturists here prefer for the crop the loamy sand of the calcareous order ; deep black soil does not suit it at all, for it assists the natural propensity of its roots to penetrate deep in the soil, and thus to cherish large kandas to uselessness.

PLOUGHINGS.

The soil to be grown with this crop is not required to be ploughed. Such is the opinion of the cultivators of long standing. They say that ploughing makes the soil easy of penetration by the roots ; and this very fact reduces the value and usefulness of the produce ; *second*, if its roots are once penetrated deep, the soil cannot be cleared of them entirely. The remainders do great harm to any other crop made on the soil to the considerable loss of the owner. These facts, say the Berar agriculturists, induce them to prepare fields by making use of "buckhars" only. With this they turn up the soil. Its action is confined only to the surface soil. After turning the soil up and down a little, they sow the seed by a drill in closer lines. It is generally sown after the Mrig-showers watered the fields. A bigha requires about four payalis (kacha seers) of seed. If jwari is the object of growing with it, every payali (4 kacha seers) should be mixed with one seer of jwari. About ten days after, germs are seen peeping modestly on the field. The field should be weeded no sooner does the crop reaches the height of an inch. The work of weeding is generally done either by manual labour, or by an instrument. It requires three years to be ripe. The first year's expenses are defrayed on the income of the jwari sown with it. The second year gives a good crop of its seed which is quite sufficient to bear that year's expense on the field. During the third year the root crop is ready. The seed is sold in bazaar here at Rs. 20 to 40 per khandi (20 kacha maunds).

PREPARATION OF ITS SEED.

The trees bear fruits during the second year. The fruits are very hard. The shells of the fruits are filled up with small black grains. Having picked up the fruits from the trees, they are rotten being mixed with double the quantity of dung. While the fruits are being putrified, they are trodden either by men or by bufaloes. They are putrified to such an extent that the scene becomes very detestable. The pile itself becomes a lovely abode of dirty worms and insects. (This must be done at great distance from the habited locality to avoid nuisance.) This filth is taken after a fortnight to a river, where the fruits are washed clear, and broken too. The small grain are obtained from them. The ash of the husk of the fruits is very useful, as they say, to rub the teeth with.

No manure is required, or at least they do not use it for the crop. At the end of the third year the roots are dug to the depth of 4 to 5 feet. These roots are dug at the rate

of 3 pies per seer. A male person digs about 5 seers a day. The income per bighah is roughly estimated to be from 3 to 3½ kacha khandis. In bazaar a khandi fetches from 40 to 60 rupees to the seller.

S. C. G.

Amraoti, 1st April 1883.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly Meeting of this Society was held on Wednesday, the 21st March 1883.

W. H. Cogswell, Esq., President, in the Chair.

The proceedings of the annual general meeting were read and confirmed.

The following were elected members :—Moonshee Madho Lall, Majors E. C. Corbyn and F. R. Lowis, R.A., Miss De Momet, Messrs. D. M. Morrison, R. R. Waller, D. J. Zemin, and H. J. Joakim.

Mr. C. A. White, Assistant Engineer, P. W. D., Hazaribagh, was proposed as a member by the secretary, seconded by Mr. J. E. MacLachlan.

Contributions.

1. Administration of Bengal, 1881-82, and Report on its external trade for 1881-82.—From the Government of Bengal.
2. Report on the Government Botanical Gardens of Saharunpore and Mussoorie.—From the Superintendent.
3. Monthly meetings of the Agricultural and Horticultural Society of Madras for December 1882, and January and February 1883.—From the Society.
4. Report of the Queensland Acclimatization Society for 1880 and 1881.—From the Society.
5. The *Indian Forester*, Parts 3 and 4 of Vol. VIII, Nos. 1, 2 and 3 of Vol. IX.—From the Editor.
6. *Tropical Agriculturist* for January and February 1883.—From the Editor.
7. Report on Kew Gardens for 1881.—From the Director.
8. Journal of the Asiatic Society of Bengal, Part I, Nos. 3 and 4, Part II, Nos. 2, 3 and 4 for 1882, and Proceedings for December 1882.—From the Society.
9. Memoirs of the Geological Survey of India, Vol. XIX, Part 3, and of *Palæontologia Indica*, Ser. XIV, Vols. 1—3.—From the Superintendent.
10. Report of Chamber of Commerce for half-year ended 31st October 1882.—From the Secretary.
11. Calcutta Exhibition of Indian Art Manufactures, 1882.—From the Committee.
12. Journal of the Bombay Branch, R. A. Society, No 11, Vol. XV.—From the Society.
13. Four kinds of Palm Seeds.—From the Director, Royal Botanic Garden, Mauritius.
14. A quantity of cuttings of the Aloo Bokhara and vines.—From Superintendent, Botanic Garden, Saharunpore.
15. A quantity of Pean Seeds.—From Mr. John Stalkartt.

The President having announced a valuable donation to the garden from Mr. W Stalkartt of two fine large plants of *Araucaria Cookii*, the best thanks of the Society were voted to that gentleman for this acceptable contribution. They have been planted out near the principal entrance gate.

Apricot Oil.

Captain Banon, 39th Native Infantry, submits a specimen of oil extracted from the kernel of the apricot of the north of India, and requests an opinion as to quality and value.

Messrs. R. Scott Thomson report on this specimen : "Is a good, pure oil, and may be used for all the purposes for which ordinary almond oil is at present employed. We have tested it to 10° Fahrenheit, at which point it does not congeal, which would make it suitable for lubricating fine mechanical works. There would be scarcely any demand for it in this country, but no doubt if it could be landed in England at 9*d.* per lb, it would meet ready sale. The actual value of it as an article of commerce can only be ascertained by sending a trial shipment of it to England."

Garo Hills Cotton.

Read a letter from the Under-Secretary to the Government of India, Agricultural Department, requesting to be informed if the Society can furnish any further information regarding cotton from Chittagong and the Garo Hills. The secretary mentioned that all the information possessed by the Society had been introduced in the proceedings of last year.

The following is a note now furnished by the Government in continuation of the subject :—

The Revenue and Agricultural Department received lately from the Chief Commissioner of Assam, sample of a class of cotton which is grown in the Garo and Chittagong Hill Tracts. Quantities of the staple were sent for opinion to the Empress Mills at Nagpore, to the Elgin Mills, Muir Mills, and Woollen Mills at Cawnpore, to the Egerton Woollen Mills at Umritsur, to the Indian Carpet Manufacturing Company at Allahabad, and to the Agri-Horticultural Society at Calcutta.

The opinions received are unanimous in declaring the cotton unsuitable for spinning purposes by itself, because of the shortness of the fibres and their hard, unpliable nature, which gives them the tendency to separate themselves from each other instead of uniting together on receiving twist. The staple is said to resemble in almost all respects the Nagpore *jherry*, or what is in the Berars called *belaiti* cotton ; but it seems to be more regular in length and slightly stronger. The introduction of seed of this cotton into the Central Provinces is deprecated by the Manager of the Empress Mills, who some time ago also brought objections against the Nagpore *jherry*.

The cotton does not, however, seem to be altogether useless. It is valued, and highly so, for mixing with certain classes of wools, from its hard, harsh, and crisp fibre ; and in fact is said in some respects to more resemble wool than cotton. For carpet-making, too, the Indian Carpet Manufacturing Company of Allahabad approves of it, and asserts that it is a superior commodity, and would be valuable for the finer kinds of stair and carpet cloths. The cotton has already attracted attention in commercial quarters, and an export trade has sprung up. The Deputy Commissioner of the Garo Hills District (Captain H. St. P. Maxwell) reports that, roughly, the amount of cotton exported annually from that district is not less than 40,000 maunds when cleaned. The official returns of trade on the other hand show that 35,300 maunds of cotton are exported from Chittagong *viâ* Naraingunge. The Agri-Horticultural Society reports that the staple is already being extensively used in the manufacture of Saxon woollen fabrics on the continent of Europe.

The wholesale price of the cotton in the Garo Hills district varies from Rs. 10 to Rs. 17 a maund according to the season of export and trade demand. The price in Calcutta varies between Rs. 18 and Rs. 19 a maund.

Waste land is very abundant in the Garo and Chittagong Hills districts, and Captain Maxwell reports—referring to his figure of export (40,000 maunds)—that treble that quantity of cotton could be grown by the Garos if a ready market was available.

A few years ago an attempt was made to induce the hillmen to remove the seed prior to packing the cotton for sale, and for this purpose a large number of simple machinery were imported from Calcutta and distributed among them, but the movement met with no success. Captain Maxwell, who mentions the fact, explains—

"I have noticed, however, that a Garo is susceptible to improvement when the change carries with it a pecuniary advantage ; and I have no doubt that if the value of cleaned cotton at the local markets makes it worth while for the Garo grower to produce it in this state, he will do so. The lack of enterprise is not so much with the Garo as with the first purchaser of the plains, who generally is too apathetic and indolent to enter into a vigorous trade."

He adds :—"If an inducement is held out to export the cotton from these hills in a cleaned state, I will take every measure to see that the advantages to be thus obtained are carefully made known to the interested parties."

A demand seems to exist in Australia for just this sort of cotton for mixing purposes. A sample of it, sent by the Revenue and Agricultural Department to a firm in Melbourne, was reported on by it "as splendidly suited to their purpose 'if cleanliness is kept up to sample.'" The first cost, however, was considered rather high, for, to the price then ruling, *viz.*, Rs. 19 per bazaar maund in Calcutta, was to be added rate of freight to Melbourne.

More recently a fall in price occurred ; and the firm availed themselves of the opportunity to send an order to Chittagong for a small trial consignment. The result is not known yet.

American Sumach.

Read the following letter from Colonel J. Stewart, R.A., Superintendent, Harness and Saddlery Factory, Cawnpore, in reference to the Divi-Divi :—

Having seen in the proceedings of your Society, published in the *Pioneer* of the 15th instant, a mention of American Sumach or Divi-Divi (*Cæsalpinia corriaria*) as a useful plant for tanning leather, I beg to inform you that I have successfully reared the plant for the last 20 years in Cawnpore, where the grounds of the factory of which I have charge are covered with plantations of it.

I originally got the seed in 1862, from Bangalore, where the officers of the Madras Artillery had plantations of it for use in their regimental tannery. Subsequently more seed was procured from the Botanical Gardens at Calcutta, and the plant has thriven very well here, though the seedlings require great care and cultivation for the first few years.

The frost of the cold weather in these Provinces is injurious to the young seedlings, and protection is required for them. Field rats are great enemies to the growth of the plant.

I have distributed seeds from Cawnpore to several applicants for them, and am prepared to distribute more if required.

The secretary intimated that he had requested from Colonel Stewart as full information as he could kindly afford of the ages of his trees, the quantity of pods obtainable from each, and the weight required for tanning leathers of certain kinds in comparison with native tans, &c. He had also applied for seed to meet a probable steady demand, now that the value of the divi-divi was becoming more generally known.

In connection with the above, a note was introduced from Mr. S. S. Jones, C.S., Divisional Officer, Deoghur, sending a few particulars from the Forest Officer of the Sonthal Pergunnahs. Mr. Jones has likewise promised a quantity of seed.

Also an application from the Executive Engineer of the Brahmini Division, Cuttack, for seed of divi-divi for trial on the canal banks. (Complied with.)

Japan Pea.

The Secretary submitted the following note from Captain Pogson in respect to the Japan pea sent to him (and to some other correspondents) in the early part of last year :—

The seeds of Japan pea received by me in February 1882, were partly distributed to several gentlemen at this station (Dehra). The seeds germinated, and I was subsequently informed that all

the plants died off during the hot weather. At Mussoorie some seeds of this pea, sown in a friend's garden, germinated, grew to the height of two feet, flowered, and bore two pea-pods at the joints of each twig. These pods were just like the pods of the *urhur dal* (*Cajanus sativa*), the leaves were very like those of the *moth dall*, only round at the end instead of pointed.

I suspect the Japan pea seed sent to the Society was not the variety so highly spoken of in America. I enclose a photo. of the Japan pea as produced in Mr. Gregory's seed farm, and think it would be a good plan for you to send him the photo. and ask to be supplied with the seed of that particular Japan pea. In the *Indian Agriculturist* for December 1882, pages 454-55, there is a very interesting paper on the subject of this pea, of which it seems there are four kinds, *viz.* "the yellow, brown, round black, and long black." The pea sent me is of the usual pea colour, which makes five varieties.

It would be advisable to obtain some of each kind to be packed in tin before shipment.

Information as to time of sowing in Japan should be asked for.

As regards seed from Mr. Gregory, if despatched so as to reach Calcutta in August, they would be in growers' hands to sow as soon as the rains ceased, which would be by the 10th to 15th of September.

I came down from Mussoorie on the 26th October, and in November made two sowings of Japan pea seed, putting three seeds in each dibble, but as the seed rotted, it was clear that germinating powers had been destroyed. I kept the seed in a well corked bottle locked in a box, so no damp could have got to them. November was a very warm month, and as all common pea seed came up, the failure of the Japan pea could only be due to death of seed.

I think the pea answered at Simla, but have not heard.

JAPAN SINGLE-BULLOCK PLOUGH AND DRY RICE.

Captain Pogson sends the following notice regarding the above plough and Japan dry rice:—

It appears that the Japanese possess a plough which is worked by a single bullock. It would be, I think, advisable to secure one of these ploughs as a model, as I think with suitable alteration such a plough would suit for camel ploughing—four camels can draw a 9-pounder brass cannon and limber, with a mounted man per camel; one camel easily draws a park phaeton up hill from Kalka to Solun on the Simla road, at a trot; then why should not one camel draw a Japan single-bullock plough, made on an enlarged scale, just as well as two bullocks do the common Indian plough?

In Japan two varieties of rice are cultivated—"wet rice," on the low lands under irrigation, and "dry rice," on high lands and mountain or hill slopes, without any irrigation whatever.

If this dry rice suited the Monghyr, Rajmehal, and Beerbhoom hills, the result would be most beneficial, and greatly increase the rice-supply of the country. This rice was brought to notice by a British Consul at Japan, but I cannot lay my hands on the paper; anyhow no difficulty exists as to securing a supply of seed rice of this variety. But it should be packed in tin, otherwise the sea air will kill the seeds. I am prety certain that the dry rice of Japan would suit the Himalayas north of Umballa, and so on to Kangra, which already produces very large quantities of wet rice. It would be sound policy to introduce this dry rice into such parts of the Afghan frontier where wet rice is now cultivated. The Government of India might, if asked, help in this matter. (Referred to Government of India.)

MEXICAN ALOE FIBRE EXTRACTOR.

Read a letter from the Under-Secretary to the Government of India, Agricultural Department, returning the model of the Mexican aloe fibre extractor,—*see* proceedings of November and January last,—and forwarding a working machine four-fifths of the size.

Mr. T. F. Peppe, of Arrah, in allusion to the above machine, writes as follows:—

"I am anxious to know something of the machine for cleaning *Agave* fibre, which I understand is now in Calcutta, and want to know what it costs, and if it does the work required thoroughly or only partially. I have been experimenting in the matter of fibres in connection with a tea estate, and have therefore seen that a machine, such as they use at the Mauritius, is urgently required both for *Agave* and *Faurcroya* fibres. I saw samples of the latter fibre at home valued at £46 per ton, and as the plant flourishes in Chota Nagpore, I do not see why it cannot be produced on a large scale. If you can assist me in regard to the preparation of *Agave for Faurcroya* fibre I will be much obliged."

The secretary mentioned that he had informed Mr. Peppe that the above machine was available for another to be made from it, and that he might obtain some useful practical information on the subject generally from the Superintendent of the Hazaribagh jail.

COMMUNICATIONS ON VARIOUS SUBJECTS.

The following papers were also submitted:—

1. From C. F. Manson, Esq., Doomka,—a paper on the mohwa, its useful properties, &c.—(Transferred for Journal.)

2. From the Under-Secretary, Government of Bengal,—a Note on Wheat Mildew.—(Transferred for Journal.)

3. From E. H. Man, Esq., Port Blair, intimating, in reply to enquiry, that the quantity of tea seed forwarded in the cold season of 1882, through the Society's agency, has germinated well, and the young plants are all healthy and progressing satisfactorily.

4. From W. Lee, Esq., Ranghur Tea Garden, *viâ* Naini Tal, reporting the failure of the Japan potatoes presented by Mr. H. A. Firth.—(*See* meeting of April 1881.)

5. From the Executive Engineer, Brahmini and Byturni Division, Cuttack, applying for a quantity of nuts of *Areca catechu*, with full instructions as to cultivation, probable yield, &c. (Seed partially supplied and information given. More seed to be supplied next season.)

6. From Under-Secretary to the Government of India—forwards copy of a letter from the British Consul at Manilla, respecting model of a Manilla hemp extractor. With regard to hemp extractors, writes Mr. Wilkinson: "I found, on enquiry, that none can be had here, and the province of Manilla itself produces no hemp; but I have written to Albay, which is the centre of a large hemp district, in order to obtain the required model, which, if sent to me, I will at once forward to the Agricultural and Horticultural Society as desired."

SELECTIONS.

FIRE CONSERVANCY IN INDIAN FORESTS.

THE heavy expenditure annually incurred by the Forest Department under the head of fire conservancy, and the partial success that has attended its efforts to control jungle fires, induces me to invite attention to the matter, and inquire whether the benefit the forests have derived since this branch of forestry has been organized compensates for the enormous expenditure incurred thereon?

Forest fires, beyond doubt, may claim the same antiquity as the forests they now overrun. If, therefore, they are so destructive to seed life, and such a hindrance to the perpetuation of forests, as has been alleged, it seems worth while making an effort to account for the jungles in India containing such magnificent timber trees when the British took possession of the country, and to explain how it is they have continued to meet the heavy demand made on them since that period. I confess my inability to find a solution to this apparent anomaly, though it is possible there may be others, who are in favour of fire conservancy, who will clear up the difficulty, and explain what I am at a loss to understand. What I desire to know is, whether indisputable *facts* exist which tend to prove the destructive nature of jungle fires, or whether the consuming nature of this element has been made the excuse for failures in arboriculture that could not otherwise have been satisfactorily accounted for, and Government thereby induced to sanction an elaborate system of fire conservancy *at any* cost?

My experience in the matter makes me sceptical, and tends to the belief that jungle fires are *not* as destructive to forests in India as they are said to be. Indeed, I would venture even a step further, and ask whether it is not possible that these annual conflagrations are not calculated to do more good than harm, by opening out the soil, consuming rank vegetation (that renders a forest life so deadly), destroying insects, checking the too rapid increase of the wild beasts, and admitting a free circulation of air? The finest timber, beyond question, is to be found where trees are not crowded, where there is a free circulation of air, and where blight is not apparent; and it is only in forests (in India) through which fires annually travel that such conditions prevail. Nature has a mysterious way of fulfilling her various duties, and it yet remains to be proved whether she has not in the present instance sought the services of Hephæstus to bring about a series of conditions essential to plant life.

After a forest has been fired, the ground presents a net-work of cracks, varying in width and depth. These fissures, on the first burst of the monsoon, admit of water, air, and other gases, coming in contact with the roots of the plants, and serve to destroy unhealthy acidity in the soil, and to promote the decomposition of vegetable matter.

Soils, like plants, are composed of organic as well as inorganic matter. The organic part of soils is chiefly derived from the remains of vegetable and animal substances. This organic matter, by the action of alkaline substances, is resolved into ulmic and humic acids. As the vegetable matter decays, this organic portion of the soil also gives to the land the various inorganic substances found in its ashes.

The inorganic part of soils consists in general of saline soluble substances, and of certain earthy insoluble substances. From these soluble compounds the plant obtains nearly all the saline matter contained in its ash. The rain dissolves these saline substances, but in dry weather they re-ascend to the surface, and are thus brought in contact with the roots of growing plants.

The surface soil of tropical forests during the rainless months is known to be dry and indurate. It stands to reason, therefore, that when the land is not loosened either by artificial means, or opened out by the agency of fire, much of the organic matter or humus is washed away (especially in the case of teak trees which affect hill-sides), or takes a longer time to reach the spongioles of the trees than would be the case had the land on which they grow been opened out by whatsoever means. Apart, therefore, from the fact that forests, whose surface is not broken up, are robbed of much nutritious matter, the trees in a measure lose the full benefit of the early rains, and remain dormant for a longer period than would be the case had moisture permeated to their roots at the first burst of the monsoon. Thus far I have endeavoured to give my reasons for supposing that jungle fires act beneficially by opening out the soil to the free and early action of water, air, and other gases.

From a sanitary point of view, I presume none will gainsay the benefit jungle fires bring about, by consuming the rank vegetation that alike poisons the air and water in localities where forest-officers spend the best part of the year, and from the effects of which

many valuable lives have been sacrificed. I learn from the resolution on forest administration in British Burmah for 1880-81, that of the superior staff, comprising seventeen officers, seven suffered from jungle fever, one died, and one, after a prolonged and severe illness, had to leave the provinces. This return bears unfavourable comparison with that of previous years, and tends to the belief that the unhealthy condition of the department is increasing in ratio to the progress made in fire conservancy.

Beyond doubt jungle fires allay blight, and destroy insects pernicious to trees; but whether the good they effect in this respect compensates for the damage they are supposed to do, is a matter for serious consideration. I have seen extensive plantations of teak, kiker, and sissoo utterly ruined by small black hairy caterpillers that feed on the buds; and have also seen plantations of the same trees unscathed by jungle fires that have been rapid in their course, a circumstance borne out by the following extract from the resolution on the forest report of British Burmah for 1880-81:—"In the Pegu circle the protection from fire of eighteen reserves and plantations was attempted. Fire occurred in ten of these. In some cases the fire was very trifling, but in several instances there were serious conflagrations. It is, however, satisfactory to find from later reports, submitted after examination of the principal reserves which suffered, that the damage done is not serious. In the Mokeka-Beelin reserve none of the trees appear to have been killed. In the Bewet reserve the actual damage has not been found to be so great as was at one time feared, although a good many of the teak plants have perished."

Now, in respect to the loss of life from wild beasts, forest reports are silent; it is difficult, therefore, to arrive at any satisfactory conclusion regarding the part jungle fires play in suppressing their perpetuation or increase. It is on record, however, that within the last two years 246 men have been carried off by tigers in the Sunderbuns Forests division, an area that comprises the wooded portion of the gangetic delta, where, as a matter of course, jungle fires never occur, and tigers abound. All who have indulged in the delights of tiger-shooting know it is hopeless to expect shikar in jungles recently burnt over, and naturally wend their way to those forests in which fire has been best controlled. In 1881 the largest number of tigers killed in the Madras presidency was in the Malabar district, where fire cansorvancy does not exist.

I have now illustrated how it is possible that jungle fires may be more beneficial than injurious to forests, and must leave it to those who are in favour of fire conservancy to correct my views where they are at variance with existing *facts*. Controversy unquestionably is the best means of developing truth, and all I desire is to arrive at the real truth of the question at issue.

From 1876-77 to 1880-81 over 1,00,000 rupees have been expended on fire conservancy in British Burmah and the Central Provinces, and, according to recent resolutians of the Government of India, it would appear that the whole area protected from fire in these provinces during that period must be retraversed by fires once every eight and nine years respectively. At the present rate the annual conflagrations are encroaching on the areas protected. With such startling facts on record, it seems high time that the *pros* and *cons* of fire conservancy should be most carefully considered, and a more economical and efficacious system introduced if possible.

Referring to fire conservancy in Burmah during the year 1880-81 the Chief Commissioner writes:—"The business of protecting reserves from fire forms a very difficult problem in Burmah. This year we have spent 10,000 rupees in attempting to protect from fire 98,000 acres, out of a total of 1,300,000 acres of reserved forests: yet fires occurred once, and more than once, in sixteen reserves out of twenty-eight to which our efforts were directed. The reserves will probably aggregate 2,500,300 acres before the demarcation work now in contemplation is finished. At the present rate of charge the fire protection of this great area would cost over two and a half lakhs of rupees. Even then we could not hope to keep out fire in years of rainless spring and summer months, or from forests where bamboos had flowered over large areas. It is comforting to find that teak of good growth seems to escape almost unscathed from ordinary fires, and that even teak plantations, on toungyas or elsewhere, have suffered much less from fire passing over them than would have been expected. Though this is so, nevertheless the work of protecting from fire a yearly-increasing area of reserves and plantations must be maintained as one of the primary objects of forest conservancy in Burmah." Here, again, we have striking proof of jungle fires not being as destructive to forests or plantations as one is led to suppose from the amount that is yearly expended on their suppression and control. However this may be, certainly I concur with Government in condemning the present system of annually increasing the area protected from fire before that first attempted has been rendered comparatively fire-proof. The resolution explains "that fire protection, in order to be of real value, must be continuous, and that, before further extensions were attempted, it was necessary to make sure that the forests previously taken in hand were quite safe. . . . No further extension of fire protection should ordinarily be taken in hand until the existing areas under protection are made quite safe. When this has been accomplished and new areas are brought under protection, they should be shown separately, so that it may be possible to trace the results, in the case of each block, from the time when protection commenced in it. The only effect of increasing the area attempted is to diminish the apparent amount of failure without doing any good."

Now, in respect to teak, and bearing in mind that this tree is not gregarious in its habit, but grows amongst trees of comparatively no value, it occurs to me that a considerable saving might be effected, and better results obtained, were fire conservancy confined to areas where teak seedlings grow most abundantly, and that when the seedlings have attained a sufficient growth to be beyond the influence of fire, a new plot be taken in hand, and so on. If the areas now protected from fire were carefully examined, I am satisfied that nearly fifty per cent of the land would be found occupied by trees or scrub jungle comparatively valueless, and that consequently a far larger amount is expended on fire conservancy than there is any necessity for

*** Subsequent to the completion of this paper, I have seen the "Progress Report of Forest Administration in the Hyderabad Assigned Districts" for 1881-82. Corroborative of my views regarding the evils that arise from fire conservancy, the Conservator writes:—"Hitherto the beneficial effects of fire conservancy, such as the creation of a forest soil, increased reproduction, diminution in the rank growth of grass, &c., have annually been recorded, but I now have to bring to notice an evil which is making itself felt more and more every year, viz., the enormous increase in insects, some troublesome only to man and animals, other injurious to vegetation. Among the latter may be mentioned a caterpiller which in the first break in the rains, especially if it is a long one, attacks the teak tree in swarms, leaving it almost bare of foliage, and thus checking its growth to a serious extent. Teak seedlings, too, suffer great injury from an insect which buries its eggs in the latest growth. On the production of the larvæ large excrescences are raised, and the leading shoots ultimately killed. How far this insect will effect the future of the trees remains still to be seen. The 'borer,' too, is becoming much more plentiful than formerly." I differ, however, from the opinion expressed in respect to fire conservancy being beneficial to forest soil, for I hold the reverse to be the case.—S.—*The Journal of Forestry.*

FOREST PROGRESS REPORT FOR BRITISH BURMA,H 1881-82.

THE report before us shows how very successful Forest Administration has been in British Burmah during 1881-82, and how vast are the timber resources of that rich province.

Demarcation work is still in progress, and the total area of the reserve forests was 3,274 square miles, or somewhat less than that of the reserves in the North-Western Provinces. It would be interesting if the proportion of the reserved forest area to the total area of the province were always given in Annual Reports.

Eight hundred and thirty-six square miles were added during the year, most of the new reserves containing more or less teak-producing land except the Mindone Yowa in the Prome Division.

Reservation in Burmah interferes very little with the privileges of the people, because the very large forest area left outside the reserves more than suffices for all their present wants. The wild uncivilised Karen, never accustomed to restraint of any kind, naturally objects to forest reservation, and the Pegu Conservator very graphically explains his views. He says:—"The Karens themselves say that once they were like jungle-fowl, hiding where they liked, scratching the earth here and there and putting in a grain of rice and eating what came of it, if the *nats* (*i.e.*, spirits, permitted, but that now the Forest Department put them into boundaries here and boundaries there, and they feel like pigs in a pen. But after a certain time they rarely deny that their latter state is preferable to their former, more especially in or near fire-traced reserves, where work is constantly obtainable"

Forest reservation will, we may be sure, have a great civilising effect on these interesting people, they will learn to settle down in the neighbourhood of forests where labor is constantly required, and by more frequent contact with Europeans and civilised Burmans will become useful, instead of destructive, members of the community.

In the reserves there are very few rights, and those that do exist, such as the use of bamboos for home consumption and grazing rights, will not be detrimental to the future of the forests.

The fact that the export line of the two new reserves in the Tounghoo Division lies through Upper Burmah, shows what a defective frontier we have there, and that some rectification is required.

Fire protection has been extremely successful, and in spite of the great difficulties which have to be overcome, will compare favourably with that in any of the other provinces under the Government of India, as only 1·6 per cent of the protected area was burnt.

Incendiarism is common, and several fires occurred from this cause. One of these happened at the Magayee Plantation, and the Extra Assistant Commissioner decided that it was the fault of some forest subordinates, without taking the trouble to examine three eye-witnesses. This is an evil which it is impossible for Forest officers to check, unless they receive every assistance from the Civil authorities.

Mr. Ribbentrop gives an interesting account of the consequences of frequent fires. He says—"The first consequence of these constantly recurring fires are bamboo forests with standard trees in the hills, and Kaing grass savannahs in the plains. The cover of head leaves on the ground is annually consumed, and no humus is formed.

"The rain-storing power of the forest is lost, and the bare friable soil is washed down into the streams. Wherever a small flat stone, a piece of wood, or some other obstacle protects the ground, this forms after the rains the roof of a little mud pillar, and the soil round it having been washed away and carried down by the streams, is doubtlessly one of the main causes of their rapid silting up. This errosion does not take place in areas which have been successfully fire-protected for some years, and the streams in fire-protected forests become more and more perennial."

The plan by which Karens and other forest people protect the forest areas near their own settlements is excellent, and will doubtless be extended, seeing that the cost of protection in this way is a quarter of that by any other method.

Eight hundred and seventy-two acres of plantations were made during the year, and principally consist of new teak toungyas, containing over 600 seedlings per acre. It is hoped this system will be extended until Mr. Brandis's programme of 2,000 acres per year is carried out.

Four hundred and fifty acres covered by flowering bamboos (species not mentioned) were burnt, and planted up with teak seedlings on the toungya system, 500 acres being burnt for further operations. As the Chief Commissioner remarks, the system is an excellent one, especially as it can be seen the season before, by the bamboos not sending out new shoots that they will flower next year.

The reproduction of Cutch has been tried with success in the Tharawaddy Division, and an attempt will probably be made to create large Cutch toungya plantations in the Thayetmyo District.

Experimental cultivation of various exotics has been continued on a small scale with varying success. The experiments are generally carried on in a half-hearted way, and success is imperilled by unwise economy in cutting down expenditure on weeding, fencing, watering, &c.

Mahogany would do well if it were not for the attacks of insects, probably the larva of a beetle. It is stated that "some trees have their terminal shoots eaten off, while others are attacked just above the collar and simply girdled, others again are bored along the whole length of their stem." This liability to injury of introduced species is very curious, and has caused a great havoc amongst Australian trees at the Cape.

Tea and coffee grow at Thandawy, and it is hoped that private capital may be attracted to the locality as soon as the railway to Tounghoo is opened.

Broussonetia papyrifera appears to be as much at home in Burmah as it is in the Himalayas, and there is a thriving little plantation in Tharawaddy.

The Vanilla orchid will probably be successfully cultivated at Magayee, where a vanillary has been built, and where two-year-old plants have fruited.

Over 24,000 trees were girdled, including nearly 19,000 teak, all save 200 trees being in the non-demarcated area, where it is calculated that 40,000 marketable teak remain, and then work will be commenced in the reserves.

Foresters in the older provinces will read the part of this report dealing with the yield of the forests with unmixed feelings of envy. Revenue was collected on 76,000 tons, or 3,800,000 cubic feet, and free permits were given for over 42,000 tons of timber, according to the review by the Government of India, although it is not understood how the latter figure is arrived at, seeing that free permits are given for trees without specifying dimensions, these trees being all cut outside reserves and not marked in any way.

This large yield, it must be recollected, only shows the outturn of teak 31,000 tons, and the 16 other reserved kinds 87,000 tons, and is exclusive of all the other numerous species of timber, many of which, such as Mango, Tonkkyan (*Terminalia tomentosa*), Yone (*Anogeissus acuminata*), Petwoon (*Berrya ammonilla*), are regarded as valuable trees in other parts of India. No free permits are required for cutting any trees save the reserved kinds outside the demarcated area, and nearly 30,000 logs of 72 different kinds passed through the revenue stations of the Rangoon Division alone in this way free of duty.

One lakh thirty thousand tons (6½ million cubic feet) of teak, valued at over 100 lakhs of rupees, were exported from Rangoon and Moulmein, this including of course a large quantity of timber from Upper Burmah. Of this timber, England took 50,000 and India 80,000 tons, the exports to other countries being insignificant.

The rates realised were high, being in Rangoon on an average Rs. 66 per ton for first class, and Rs. 42 for second class timber, and at home varying from £13 to £15 per ton.

As a proof of how little the Forest Conservancy in Burmah presses on the wants of the people, the revenue derived from minor produce was only Rs. 8,000; if we exclude the revenue on Cutch, Rs. 48,000. Grazing and fodder grass realised the small sum of Rs. 132.

Four-and-a-half million bamboos and ten million palm leaves for thatching passed through the Rangoon revenue stations free of duty.

Rs. 57-6-0 were received on 11¼ million cheroot leaves (from *Cordia myxa*) in the Tharawaddy Division.

Wood-oil is chiefly extracted from Kanyin (*Dipterocarpus laevis*), one man tapping from 30 to 40 trees in the season, from which he extracts 150 to 200lb of oil, sufficient to manufacture 2,000 to 3,000 torches, which sell locally at Re. 1-8-0 per hundred.

Although only Rs. 56,000 were credited as revenue from minor produce, the value of exports from Rangoon and Moulmein exceeded 36 lakhs of rupees, the articles exported consisting of gums and resins, cutch and gambier, stick-lac and wood-oil.

Thirteen lakhs of produce were sent to the United Kingdom, and over 9 lakhs found a market in India.

The financial results of the year are very satisfactory, and the surplus of nearly 11 lakhs of rupees exceeds the total receipts of many other provinces.

The surplus, however, is an exceptionally large one, and is due to a rise in the price of teak, and in consequence a larger out-turn of that timber, as well as to the supply of sleepers, &c., for the new railway to Tounghoo. For this purpose, the Rangoon Division supplied 16,000 Pynkado (*Xylia dolabriformis*) logs, and the agency, Tounghoo and Sheweygheen Division supplied over one lakh of sleepers, principally of Pynkado (*Xylia dolabriformis*) and Laiza (*Lagerstraemia tomentosa*) with a few of Teak and Tonkkyan (*Terminalia tomentosa*). These sleepers and other timber supplied to the Rangoon and Irrawaddy Valley State Railway, a large portion which was cut within the reserves, gave a revenue of more than 3½ lakhs.

Excluding the 10 elephants attached to the Agency Division, there were 33 elephants belonging to the Department. Their feed cost Rs. 1,038, or the moderate sum of Rs. 2-10-0 per month. In the Rangoon, Tounghoo, Western, and Sheweygheen Divisions, the cost of the food of 13 elephants was *nil*, as forest fodder sufficed to maintain them in good condition, and no rice or paddy was given. The average cost of feed and keep, including gear, is not however less than Rs. 50 per animal per mensem.

Dynamite was successfully employed in many cases to remove rocky obstruction in timber-floating streams. One of Ransome's stream tree-fellers has recently been procured from England, for use in the preparation of locomotive fuel, for the Irrawaddy State Railway, and we hope it will prove a good investment financially.

Mr. Ribbentrop, who has now left Burmah for his old province, the Punjab, has been warmly thanked by the Chief Commissioner for the excellent service he has done in the Burmese forests.

SUGARCANE CULTIVATION.

ABOUT two months ago, the Government of India, in the Agricultural Department, issued a rather interesting order on the sugar industry in India, the growth and cultivation of sugarcane, and the manufacture of sugar. The returns submitted at the time go to show that the industry has not fallen off, but that it has not made the progress it ought to have, and while in many other branches of industry there has been an advance, such as the cultivation of coffee and the growth and manufacture of tea, sugar has almost kept its old position. In dealing with the subject, the Government of India gave no special attention to sugar cultivation in this presidency. The subject was discussed more with reference to the North-West Provinces, Bombay, and Bengal, and Madras was quite forgotten. True it is that the Madras presidency has not taken a very prominent position in the growth of the cane and the manufacture of sugar; but there was a time, not very long past, when the production of sugar in the mofussil districts of this presidency received very great attention, and when European capital largely embarked in an enterprise which did not turn out as well as anticipated. It is said that the total annual production of sugar in this country is about 2,000,000 tons, besides the produce of palm trees, which yield about 150,000 tons. The total production of sugar is not equal to the demand, and hence it is that about 986,000 tons are annually imported from Mauritius and other sugar-producing centres. This large quantity is chiefly attracted to Bombay and Central India, while the Madras presidency contents itself with supplies from the northern districts and Bengal, where the trade is large, and where the manufacture of sugar, though not keeping pace with the progress made in other industries, has not declined.

In the Madras presidency the sugar manufactured at Aska, Bimlipatam, Chitavalsa, and other places, once commanded very good prices, and the manufacturers of the different descriptions of sugar being Europeans, merchants entered heart and soul into the enterprise, and hence the success that attended almost every endeavour to manufacture a really good article. For many years some of the leading mercantile firms in Madras had their factories on the coast ports, and at almost every successive season thousands of bags were shipped: gradually with steady improvement in the quality of sugar and the demand that existed in Europe, the sugar trade assumed large proportions, and shipments proved remunerative. But of recent years a change has come over the spirit of the enterprise, and while fine brown sugar was manufactured for shipment, the merchants are now content to ship jaggery—such as is chiefly consumed by the poorer classes, and hence the manufacture of sugar has been given up by many of the leading merchants who are content to deal with jaggery, or what is more technically called *chenee*. The worst quality—the refuse of the market—was lately sent away from Madras in ship-loads, and what likelihood is there that any decided change for the better will take place in the production and manufacture of sugar so long as exporters content themselves with the stuff sold in the market? But while this branch of export trade is not improving, the manufacture of sugar for local consumption has not declined. We have seen samples of Aska sugar that will bear competition with the loaf sugar manufactured in England and sent to India for sale; and from some of the Southern districts and from Mysore—especially from the Astragram district—the sugar manufactured is of excellent quality, and always finds a ready and remunerative market. Some years ago, a well intentioned German missionary set up a sugar factory in the North Arcot district. He was engaged in mission work and with a view to teach the newly-made Christians an industry by which they may be able to obtain a livelihood, he successfully grew sugarcane, and turned out sugar of very superior quality. Allusion to the work carried out by this zealous labourer in the mission field is made in the North Arcot District Manual. But with his death the good work begun was not continued, and what would have turned out a profitable and paying industry has been allowed to gradually die out for want of encouragement and support.

The question may, however, be asked if in the Madras presidency there is room for the development of the sugar trade. The answer may safely be given in the affirmative. The manufacture of sugar must depend upon the production of the cane, and to effect

this and, will necessitate increased attention from growers. Sugar-cane is not as easily grown as horse gram or any other dry grain. A system of high cultivation must be pursued, and if it is, the returns will fully compensate the outlay of time and money. In his report upon the capabilities and prospects of the Coimbatore district, Mr. Robertson, Superintendent of Government Farms, states that the facilities offered for sugarcane cultivation in that district are very great, but that only 3,000 acres of land are on the average planted with the cane, while under fair average conditions, a large part of the cultivable land of Coimbatore may be set apart for sugarcane which will bring in a return of from Rs. 80 to Rs. 100 an acre against crops that yield no more than Rs. 12 an acre. According to Mr. Robertson, "the Coimbatore district offers many facilities in its climate and soil for the production of sugar, and it is to be regretted that such a small area is cropped with the sugarcane." Lands specially set apart for the growth of the cane have steadily lost their producing capabilities, and where, about thirty years ago, the yield was more than 120 maunds per acre, it is now not quite eighty maunds. We need not go on quoting from Mr. Robertson's report to show that, in the mofussil districts of this presidency, the cultivation of remunerative crops is neglected, and that industries which may be worked to the greatest advantage, are allowed gradually to die out. What has been achieved in parts of the Bengal and North-West Provinces in the matter of sugar cultivation may be, with a little trouble and care, accomplished in our own presidency. The remedy is in the hands of the better classes of the ryots, and it is hoped that, with the diffusion of an improved system of agriculture, such as taught in the new School of Agriculture, this industry will extend, and bring with it increased advantages.

PLANTING AND CULTIVATING NORTHERN CANE.

By Professor W. A. Henry.

THE old sorghum plant of war times is again a claimant for a portion of the farmer's field and attention. While in the early days the excitement caused by this plant subsided as rapidly as it arose, there are reasons which show to a certainty that this time sorghum has come to stay. The plant, in emerging from an obscurity of nearly a score of years, has taken the more popular title of "Amber Cane," and with the changed name come qualities that must as surely win for it friends, as the bad qualities of the old sorghum made for itself enemies wherever it was known. Some of our Western States have already grown amber cane in large quantities, and the satisfactory sales of the syrup warrant an increased acreage. To properly plant, cultivate, and manufacture, are all points not yet understood by our farmers, and for some years to come there will naturally be much discussion upon these topics. Let us consider at this time the planting and cultivation.

First of all, good, pure seed should be secured and carefully tested. Two pounds of seed are allowed for each acre. By count I found that one ounce of seed contains 1,730 grains. This gives 27,680 per pound. Good seed should be free from the hulls, and weigh not less than 58 pounds to the bushel.

No one should think of planting without testing the seed, to see whether or not it will grow. To accomplish this fill a small box or flower-pot nearly full of earth, lay on the earth a cotton cloth, and place on the cloth 100 seeds; over the seeds lay another cloth, and then put on a layer of earth an inch thick. Water heavily at first, and place in a warm place by the stove. With proper care, the seed should be ready to examine in six days. If the seed is good, not less than 90 of the grains should show sprouts. The seed test should be made so early that a second can be secured, if the first fails.

As to the use of manures on the land, I should say that no rank stable manure should be applied direct to the land. The less manure that can be used, the better for the quality of the syrup. In general, the land should be in good heart, but it need not be so rich as for a heavy crop of corn, unless naturally so. Manure darkens the syrup, as repeated tests show.

The question of manures brings us to a consideration of the soils best adapted to cane growing. Upon this point there is quite a uniformity of decision in favour of sandy soils. Most certainly this soil pays best for cane, in comparison with stronger land, when the relative yields of this and other crops are considered. Cane grown upon sandy soil furnishes the clearest juice, which in turn makes a syrup of the lightest colour and finest flavour. Often, however, dark soils and clays make fine syrups and afford large yields.

The preparation of the soil for planting is one of the points where many mistakes are made. The ground should be much more carefully prepared for cane than for Indian-corn. Indeed, no one should allow the seed to be brought into the field until the whole surface is as mellow as a garden. To get the soil into this condition requires not only that it be well ploughed, but that the roller and harrow be well employed. The last harrowing should take place on the day the seed is planted. To get the most syrup from a given area of land, plant in drills three and-a-half feet wide, five or six seeds every 18 inches. Many prefer to plant checks, as with corn, but less cane can be grown that way. If possible, plant with some kind of horse planter, which, if it does its work properly, cannot be equalled by hand-planting. With a Keystone one-horse planter, and long rows, a boy with one horse will plant an acre an hour.

Be governed by weather and soil as to depth, but do not plant over an inch deep as a rule; often less depth will do. On some soils it will do to pack the ground over the seed, but often this is a harmful practice. I am strongly in favour of machine planting, but no matter what system is used, be sure to have the ground fresh and mellow, and plant plenty of seed. To this end, do not be limited to exactly two pounds per acre. Properly planted, the cane is half tended. Before the young cane plants appear, run a light harrow over the field, regardless of the rows. A smoothing harrow is excellent. So is one made of brush, or a flexible drag. Don't fail to harrow every three or four days, for several weeks after planting. When the cane is up, follow the harrow with the hoe, and uncover the plants that may have earth on them. Many will shake their heads at the suggestion of the harrow in the cane-field, but years ago, when its use in the corn-field was recommended, unbelievers were just as numerous. I claim that, beyond all cavil, the expense of raising a cane crop can be reduced one-half by the use of a light harrow in cultivation, but the ground must be in as fine tilth as for onions at planting time. Of course, the harrow will tear out some cane plants, but this loss should be anticipated by extra seed at planting time. The harrow can be run both with and across the rows of cane, and can be used until the cane is six inches high, then use the two-horse cultivator, as for corn, the rest of the season. The old practice of hoeing cane must be given up, just as the hoeing of corn has been. By using the harrow, as directed, the weeds that spring up are killed when just starting. When the last harrowing is being given, let the men follow with hoes and dress out the cane, thinning it where necessary. The equivalent of one stalk for every six inches, in drills that are three and-a-half feet apart, is sufficient for a large yield of syrup.

As a summary of the above:

1. Test the seed before planting, and do so early enough to secure more if that should fail.
2. Have the ground in good heart, but not made rich from rank manures.
3. Prepare the ground as you would an onion-bed, and have the soil freshly stirred on the day of planting.
4. Plant plenty of seed.
5. Use a light harrow frequently, beginning its use before the cane is up.
6. Try to use the hoe only for uncovering and thinning the plants.—*Farmers' Review.*

THE CULTIVATION OF THE POTATO.

IT is commonly thought that any person can grow potatoes, and while it is true that any person that can fit the soil and cover the seed, and cultivate the ground so as to keep down weed and grass, can grow the tuber, yet it is equally true that few farmers in our country grow the potato plant successfully. Perhaps the most obvious reason for the uncertain character of the potato crop is due to the fact that the potato plant is an exotic, that is, not originally native to our climate. Where the potato plant, named by botanists *Solanum tuberosum*, grew wild in its native soil, in South America, it was found high up from the sea level in the ravines of the mountain sides and upon the table lands, where, according to Humboldt, the temperature only varies from 55 to 80 degrees by our common themometer. This gives only a change of 25 degrees in a whole year, and as the plant makes its entire growth in less than half a year, it has been stated that during that time the range of the thermometer does not probably exceed 15 degrees. It will be seen that this condition of the temperature we cannot have; for after the tuber is planted in early spring the temperature is liable to vary 70 degrees, from 30 to 100. The only wonder is that the potato plant stands the strain of its changed conditions as well as it does. One lesson that may learned from this is, a naturally cool soil, other things being equal, should be selected for the potato. Hence a north inclination is better than one to the south. Plant corn on the south side of the hill, and the potato on the north side. But if there are no hill sides, but must grow the crop on the almost level prairie, select a spot that does not hold water, a few inches down, as is the case with a thin soil in a sub-soil of clay.

Another cause of failure in the cultivation of the potato arises from the fact that while the plant is a rank feeder, its roots cannot run far for food. Hence it needs a naturally rich soil, or one made so by proper manure. But is a proper manure for this crop? And when should it be applied? The plant is not as particular as to kind of manure, as it is to its condition. Fresh manure from the barn-yard, whether made by horses or cattle, is not well adapted to the healthful growth of this plant; while old, well seasoned, of almost any kind, may be used to advantage at time of planting. A long experience at the East taught the writer that the best way to manure the soil for the potato is, to apply a heavy dressing broadcast the year before, and use none at the time of planting. Our choice would be to apply from 10 to 20 or 30 cords of good barn-yard manure to land having a good stand of red clover. Haul it on during the winter or before the frost is out in early spri As soon as frost is gone spread evenly. Two heavy crops of hay taken off the following summer, or one for hay and one for se Then plough deep during the following fall, and turn well under all the after math, not pasturing it at all. The next spring, as soon as the ground is sufficiently dry, run a cultivator as deeply as it can be done without disturbing the soil. When the soil is well pulverized, open furrows five to six inches in depth if it is practicable, and three feet apart for erect growing early sorts, and three feet six for peachblow, or other tall viney kinds. If the object is to grow the largest possible crop from the ground without regard to economy in labour, plant in the open furrows, dropping the seed about 18 inches apart. But if square feet of ground are more abundant than strong hands, then plant the tubers crosswise of the rows, and the same distance apart that the furrows were opened. In either case the seed may be readily covered with an adjustible cultivator with two covering teeth in the outer end of the frame, running crosswise of the furrows. Or a light harrow with short teeth will answer every purpose.

AMOUNT OF SEED.

If planted in drills, use only a two-eyed piece at each 18 inches; if in hills, use two such pieces for each hill. Some prefer whole tubers at each place. But it has always seemed to the writer to be a waste to do so; for if the tuber is cut to single eyes every one will germinate, and if two-eyed pieces both will usually start well. But if whole tubers are planted before sprouting much, then but a few of the most forward buds will grow, while the others will remain dormant and soon die, acting as though conscious they would not be needed.

It will be seen that one piece in drills, or two in hills, at the distance mentioned will take the same amount per acre, which will require, if large tubers, from six to eight bushels, and if smaller ones, correspondingly less.

The most suitable soil for the healthy growth of the potato plant is a sandy loam, and if mixed with the fine gravel or slate it is no objection; but the soil should contain but a small per cent of clay, unless it is thoroughly mixed and well drained. If the soil contains considerable lime it is no particular damage, and if it contains potash or phosphorus all the better. A small handful of wood ashes thrown around the young plants just as they break ground will greatly increase the soundness and table quality of the crop, and will well repay where they can be procured for the price of half a bushel of the crop for each bushel of ashes.

PREVIOUS CROPS.

It is mentioned above that a clover sod is to be preferred. But as that is not always to be had then plant in a timothy, or June grass—*i.e.* Kentucky blue grass, or white clover sod, in all cases treated as mentioned for clover for a lage crop. In case no preparation has been made the previous year, then plant on stubble ground after wheat, oats or rye. A very good preparation is to turn under a field of rye, the last week in April or first of May, and after carefully harrowing with a short, fine-toothed harrow, plant at once. A good crop may be looked for.

There is great objection to high hills in a hot climate. On a dry or well drained soil plant deep, then never use the plough among the growing plants, but run a narrow harrow or cultivator frequently, but make no hills. The level surface, well stirred, will not dry out and cause the plants to suffer like the hilling process.

If the ground planted is so level as to make it desirable to give it surface drainage, then run a small double-mould broad plough at the middle between the rows, one way only; having arranged the rows so that a descent from it may be secured. Tile draining is, of course, better, but is often lacking.—*Farmers' Review.*

FIBROUS PLANTS IN MEXICO.

ANYTHING and everything connected with the supply of fibre, whether for textile purposes, cordage, or for paper, is becoming of more interest almost daily. A recently issued report on some fibrous plants of Mexico, with notes on their habits, will therefore be read with interest. The country under review, where the plants referred to are found, is discussed in the following paragraph:—"The river of Monterey, a tributary of the San Juan, rises in the Sierra Madre, and has for its cabeceras numerous small springs at a point known as the Potrero de Santa Catarina, say twelve miles west of Monterey, and very near the railway. A potrero or pasture here means a plain encircled by high mountain walls, to which there is but one entrance. The aperture to this is difficult, and the means of conveyance pack mules. This potrero is very extensive from north to south, entering the heart of the mountains. It has many sinuosities. On the right and left from this central desfiladero or defile there are others running east and west, called canones or canyons. Each has its special name, and there are a dozen or more. The surrounding scenery is majestic. High peaks, cliffs, gorges, chasms, great scars, and impending boulders on the river fronts of the encircling mountains. Huge pine trees adorn the mountain side and crown the top. From here there is a short foot-route *via* the Escalerias Canyon to Saltillo. There are, say, thirty small farms in this potrero, and they are irrigated by the numerous springs. The products are sugarcane, corn, wheat, barley, sweet potatoes, squash, chiote, water and musk melons. Here the 'lechugilla' grows abundantly, and much of the fibre called ixtle is made."

This plant, the lechugilla, seems to be that known to botanists as *Bromelia pita*, and, together with the maguey or *Agave americana*, and the *Palma criolla*, have attracted much attention both in Mexico and abroad, in the United States, and Europe. All the plants grow along the line of the Mexican National Railway, above an altitude of 1,000 feet, and throughout the districts contiguous. They are very prolific, growing wild upon the plains and mountain side, between Lampagos and Saltillo, and especially so at Bustamante and the Plaxeala Pass near by, where there is excellent water power from a stream flowing from a mountain spring, which has a volume of two square yards, with a fall of 200 feet in five miles. They can be gathered at all points along the line, and conveniently transported in vast quantities to an eligible locality for disintegration and shipment. The salubrity of any point on the line of this railway is said to be equal to that of the great health resorts of the world, and all, owing to temperature, altitude, and high condition, are far remote from yellow fever and other infected districts, and well suited for mining operations, manufacturing centres, and populous districts.

The lechugilla—the literal translation of which is said to be *small lettuce*—is described as furnishing a coarse and strong fibre from 18 to 24 inches in length, and is used for making sacks, mats, ropes, brushes, &c. It is the ixtle fibre of commerce, and is exported in increasing quantities from Mexico to the United States and other countries. An infusion of the root has strong detergent properties, and is extremely valuable for woollen clothing. It is said not to have the effect of disc... colours, but, on the contrary, "articles likely to fade may be washed with an infusion of the root in safety." Though it seems that the principal use of this fibre in its native country is for rather coarse purposes, it has been described as of extreme fineness, equal to the best China grass, and capable of being manipulated into the finest fabrics.

The maguey, century plant, or agave as it is variously called, is described in the report we are considering as being quite as abundant as the lechugilla. The maguey, as is well known, is the (*Agave Americana L.*) The heart of the plant yields "agua miel" or "wort," and this, when fermented, becomes pulque, an intoxicating liquor in great request by the people. The roasted heart is mescal, and this, when pressed in a mill, yields a liquid by distillation, called 'vino de mescal.' It is a strong spirituous liquid, as clear and colourless as spring water. A juice is extracted from the leaves of the plant by simply wringing them, which is said to be an excellent antiscorbutic, and has been used with most satisfactory results in cases of scrofula. The fibre can be obtained from five to even six feet in length. It is very fine, and the Mexicans weave it into fine textures. It is said that shoemakers use it to make their best thread, and the writer of the report says he has seen it "wrought into handsome money bags, ornamental baskets, &c., and then tinted with various colours. So far no machinery has been invented, or at least the Mexican people know of none, suited to break, hackle, and prepare this product. They do it in a cumbrous way by hand."

The following is given as an illustration of the extent of agave plants to be found in a given area. At Santo Ysabel, a station between Lampazos and Bustamante, the railway runs for a distance of about six miles over the land of a certain Don Solome Botello, who distils a great quantity of vino mescal. "To give an idea of the great abundance of maguey growing spontaneously on his land—all without cultivation—it is but necessary to say that 20,000 plants were destroyed in clearing the ground for the right of way. Lately, while making a short excursion across his lands, in company with the general manager and general superintendent of the road, he called our attention to the great loss of maguey leaves in taking the heart of the plants for distillation. For every plant cut 25 great leaves were left strewn to rot upon the ground, or 5,000 leaves to each 200 plants."

The "palma criolla" (*Oreodoxa regia*) is a tall-growing palm, often planted in avenues. It is described as being very plentiful. The fibrous leaves are used to thatch the ordinary Mexican hut, or if straw or other material is used for the thatch, it is nearly always tied on by strings formed from the torn leaves after being heated; this string, indeed, constitutes the common twine of the country. The fruit is somewhat similar in appearance to the date, and is some times eaten. It is also distilled, and from it a quantity of *aguardiente* or rum is made. "There was quite a large distillery of this kind near and northward from Salinas on the railway. This plant or tree has lately excited much attention, as throughout it is of a fibrous growth, trunk, leaves, and all, and some are experimenting with it with a view to the manufacture of paper." —*Planters' Gazette.*

LIME.

BY SIR J. B. LAWES, BART. LL.D., F.R.S.

THE report of the Directors of the Scottish Chamber of Agriculture contains some very interesting tables respecting the exhaustion of lime.

The directors have brought together in one page the opinons and experience of the great body of the farmers of Scotland; and according to the evidence thus supplied, the shortest period of time during which a full application of lime is said to last, is seven years; while thirty years and over is stated to be the longest period.

When we consider that the influence of lime upon a soil which is naturally deficient in this substance, is due to several distinct causes; and further that the after-treatment of the land which has received the lime differs much in different cases, we have no difficulty in understanding that there must be considerable variations in the periods of time during which the beneficial effects of lime will be apparent.

Two of the crops which are grown at Rothamsted in our ordinary rotation—roots and clover—contain large quantities of lime in their ash, and when potash is not abundant in the soil, they possess the property of utilizing this lime in its place.

The ash of leguminous plants growing in an ordinary pasture which had been well supplied with potash, contained 32 per cent of potash and 22 per cent of lime, but no pasture where potash was not supplied, the ash contained 32 per cent of lime and 14 per cent of potash. Lime therefore economises the use of potash.

The first application of lime to moor land, or to pastures which are deficient in lime, is often followed by a growth of white clover so abundant as to have led some to the conclusion that the plant was spontaneously generated in the soil! It may be observed, however, that it is only plants with creeping roots which can so rapidly cover the ground; a similar instance in the case of arable land may frequently be observed in the equally rapid covering of the soil by couch grass; this being a gramineceous plant can find in all soils an abundant supply of its own proper food—silica; but lime in many soils is by no means abundant, and if the supply is insufficient, a liberal dressing is essential, not merely for the purpose of furnishing the lime which the plant takes up, but also to enable the roots to be in constant contact with that substance.

I may [illegible] that although the amount of lime dissolved, and [illegible] nage waters is considerable, still the necessity of [illegible] the application after a few years appears to be rather due to a descent of the lime to a lower level in the soil, where it is less accessible to the roots of the plants.

Lime also acts as the medium by which nitrification takes place: and the almost entire absence of nitrates in the water passing through the peat soils in Scotland—which abound in nitrogen—must be mainly due to the absence of lime.

A reference to the returns in the table shows that the effect of lime is most durable upon pastures that are grazed; that its effects are very good upon virgin soil; that it lasts longer upon good, than upon bad, land, and upon clays and heavy loams, than upon light land.

The amount of soil nitrogen which is nitrified each year must depend somewhat upon the amount that the soil contains; but where each application of lime is attended with less benefit than the preceding one, we may feel tolerably sure that the resources of the soil have been too largely drawn upon, and that the export of fertility has been too great.

Lime therefore acts in a double capacity—it furnishes an important ingredient in the food of roots and leguminous plants; and in addition, it furnishes the key by which the stores of organic nitrogen in the soil are unlocked, and rendered available as the food of plants. It is in this latter capacity that its functions are more liable to be abused.

As lime does not furnish any of the more important, or of the more costly ingredients which plants require to form their structure and seed, it is quite evident that these must be derived from the soil: this being the case, if the views of those who hold that agriculture should be carried on without any reduction of the fertility of the soil are correct, it is evident that an application of lime should be accompanied by an application of all those ingredients which are carried away in the crops, or by feeding with stock.

My own opinion is that soils are generally competent to yield a certain portion of their fertility without injury, and that practical experience of the particular district will be the best guide for deciding the amount of fertility that may be thus removed.—*N. B. Agriculturist.*

ROTATION OF CROPS.

WHAT is the true theory of a rotation of crops? Doctors differ on the point. There is a school in this country that reduces the question of the fertility of the soil to a matter of give and take. Here, they say, is a general table of analyses of soils, and also of cultivated crops; of certain manures, &c. Nothing easier than to calculate the total yield of a crop, to know the quantity of phosphates and of potash, &c., carried off. The analysis of the manure will enable the quantity of those salts to be estimated and requisite to be returned to the soil; if in excess, the richness of the land will be augmented. It is further laid down that cereals and industrial plants draw largely on the soil for nitrogenous principles, but as these crops are succeeded by forage plants the deficit is made up by the intervention (hypothetical) of atmospheric nitrogen. Further, the necessity to practice a rotation of cropping is explained by plants not requiring the same mineral substances, so that what one leaves the other will appropriate, and that, after a lapse, say of five years—thanks to periodical manurings and dissimilarity of tillages—the alternate exhaustion and the renovation of the soil will be found equalized.

Now, what is our stock of precise, demonstrated knowledge on this subject of rotation? It is exact, that the mineral food removed must be restored. By the successive cropping of lands in Sicily with wheat, the phosphates had been exhausted, and the soil has become impoverished. The same fact was in process of realization in the north of France, till M. Corenuinder called attention to the necessity of employing phosphates, and since fertility has returned. Now for plants, as for manures, there is no constancy either in mineral or nitrogenous, or even in any other elements. Analysis shows that a large number of different manures vary in composition, from one to four times in the case of the same element. Similarly for plants; wheat, for example, where the percentage of nitrogen, as in gluten, varies from one to three. There are analogous differences for the potash and phosphoric acid carried off. Hence there is no mean, no Procrustean standard, that can be declared off-hand applicable to a special soil. Strictly speaking, each particular case demands a new analysis. One field may produce a forage five times more nutritive than another.

A popular error exists, that Boussingault asserted forage plants take nitrogen directly from the air; even his latest experiments demonstrate the exact contrary. Then the attempt has been made to explain the restitution of nitrogen to the soil by the agency of meteors and rain. It is a fact that ammoniacal salts and nitrates are constantly present in the air, and conveyed, along with other saline and dust matters, to the soil by the rain. But the latter falls on the just and unjust alike; upon all cultures indistinctly, not upon any particular rotation, and not specially on forage plants. It is assumed, but not proven, that electricity nitrifies the azote of the air in the interior of the soil, by a union with hydro-carbonaceous matters; or effects a similar end in the interior of plants, by their starch, sugar, &c. We know, however, that the azotous matters in the soil can be nitrified, but that is not an augmentation of richness; also, Cavendish has shown, in 1784, that an electric spark traversing an atmosphere enriched with oxygen, can produce nitric acid. Now, if electricity makes ammoniacal salts and nitrates in the atmosphere, that intervention is for all rotations and crops alike.

It may be laid down as an axiom, that every system of culture which does not bring, from an outside source, the materials, whether nitrates, phosphates, or potash, &c., rare in a soil and carried off by the produce, must ultimately suffer in fecundity. There is a necessity, apart from these food considerations, to rotate crops; the plan affords the means for extirpating weeds, for cleaning the ground, and of destroying insects, since if the latter, peculiar to a distinct crop, be deprived of its special food for one or two years, it must die of starvation. To keep a soil rich, depend upon manures, rather than on the air.—*Farmers' Review.*

THE WHEAT TRADE.

THE East Indian Railway Company have given the B. B. and C. I. Railway Company notice that from the 1st May, when the reduced rates under the recent arrangement for grain and seeds sent from Delhi to Bombay *via* Sabarmati, come into operation, their own rate for grain and seeds from Delhi to Howrah will be reduced also from Rs. 70 to 65 per 100 maunds. The comparative charges will then be from Delhi—

FOR WHEAT.

To Bombay	11 annas per maund.
To Howrah	10 2·5 annas per maund.

FOR OTHER GRAIN AND SEEDS OF SAME CLASS.

To Bombay	11½ annas per maund.
To Howrah	10 2·5 annas per maund.

The East Indian Railway propose making a further reduction, on and from 1st June, on this description of traffic from both Delhi and Agra to Howrah, to Rs. 60 per 100 maunds, or to, say, 9 3·5 annas per maund. The present rates for wheat from Delhi are—

To Bombay	13½ annas per maund.
To Howrah	11 1·5 annas per maund.

the difference being 2 3·10 annas. Mr. Wood, the agent of the B. B. and C. I. Company, has urged, and the Bombay Government and the Chamber of Commerce here have deemed it reasonable, that the difference in rate by the two routes might be limited to one anna per maund. The ultimate difference now adopted by the East Indian Railway is equal for wheat to 1 2·5 annas per maund, or nearly one anna (9·10) less than the present difference, which should be greatly in favour of Bombay, the route being so much shorter. The actual reductions made on both routes are, however, greatly to the advantage of the country and its trade. The reduction in the rates of the East Indian line was anticipated by Major Baring in his Budget Statement as a probable result of the reduction of the through rates from Delhi to Bombay. The Finance Minister estimated the practical result of the lowering of the rates to be, that Indian wheat would be laid down in London at a reduction of rather more than 1*s.* 6*d.* per quarter. This will, it may be hoped, encourage shippers of Indian wheat to see what further reduction of expense may be achieved, so as to enable the competition with American wheat to be carried on under more equal conditions.

As we have already mentioned, a conspicuous place was accorded in the recently issued Financial Statement to the conditions under which the export trade in Indian wheat may be maintained and developed. The English market, which takes about half the total amount—20,000 000 quarters, or nearly a million tons—from this country, is ruled not by the outturn of English soil, but by the supply from America. Major Baring gave some interesting information bearing on this question in a section of the Statement which may be turned to with advantage. We can supplement that information with facts and figures of no less interest which will be full of suggestion to all who wish to forecast the future of the Indian wheat trade. To-day we shall confine ourselves to the conditions obtaining in England, and to the enormous advantages possessed by the American supplier. We shall on another occasion glance at the elements in favour of the Indian producer and exporter; just now it is sufficient to bear in mind that Major Baring is inclined to attach considerable importance to the fact that while protection saddles the American farmer with a tax of upwards of 40 per cent on his implements and on most articles not indigenous to the country, the Indian producer and exporter are in the full possession of all the economic advantages of free trade. Bearing that fact in mind, the circumstances, which are to all appearance so overwhelmingly against our wheat export trade, need not alarm us quite so much as at first sight they might be calculated to do.

The average yield of a wheat-field in England is generally supposed to be about four quarters an acre, and the rent of such land may be put down as 35 shillings an acre. But wheat cannot be grown for a series of years in succession: it is an exhaustive crop, and requires careful treatment of the land to maintain a good average yield. The crops which are grown in rotation with it are of inferior value, and help to bring down the profit which

is derived from the farm; and taking the effect of bad and wet seasons into consideration, the gross produce may be taken as three quarters of wheat all round, which at 60 shillings is a gross return of 180 shillings an acre, and as the rent is 35 shillings, which is one-fifth of the gross produce, the remaining four-fifths are left to pay the expenses of farming, and the ordinary profit of the farmer, which is considered to be 9 or 10 per cent. The capital employed is nominally £10 an acre, and the profit expected may therefore be taken as £1. For the purposes of the income-tax the farmer's profits are assessed at half the rent, and as 20 shillings an acre is a little more than half the rent, it may be assumed that the profit is not under-estimated. Therefore, if 35 shillings be deducted for rent and 20 shillings for the farmer's profit, the remainder of 125 shillings an acre may be taken as the expenses of English farming under present conditions. These expenses are not liable to much decrease; they consist chiefly of labour and manure, and the cost of both these items is liable to increase; and if by any chance the gross money return of 180 shillings an acre is permanently lowered, then the obvious effect will be that economy must be practised in rent, or the ordinary profits of the farmer must be decreased, or both. The farmer is not likely to allow his profits to be reduced, and the necessary consequence will be a decrease in rent. The struggle which is now going on in Ireland is for the reduction of rent, because it interferes with the profit which the farmer expects to enable him to live and to thrive, as it has been judicially expressed. The same struggle is silently occurring in England, but the remissions which landlords have voluntarily granted are likely to become permanent, and where new leases are entered into the rate of rent has been decidedly lowered. It is plain that the general feeling is that the money return for produce will not be as high during the next series of years as it has been in the past, or in other words, that 60 shillings a quarter of wheat is not likely to be secured. The cause of this is not the temporary effect of two or three wet seasons in succession which has destroyed or reduced the produce of the land, but the fear of American competition. American wheat has been sold at 44 shillings a quarter in Liverpool with profit to the importer, and what has occurred is likely to occur again. This fact has demonstrated that English farming is in danger. If English wheat can only be grown at a dead cost minus rent of 120 shillings for three quarters, and that quantity of American wheat can be sold in England at 132 shillings, there is only 7 shillings an acre left for rent and for farmer's profits. It is quite obvious that under such circumstances he cannot afford to pay a penny of rent, and that his own profit must be reduced from 20 shillings to 7 shillings an acre—that is, 3 per cent on his capital. And if this is to be the result of growing wheat, the farmer would do better, if he cannot grow something else, to retire from farming altogether, and invest his money in consols or Indian 4 per cents. The question of rent resolves itself into the question—at what cost can American wheat be grown and laid down in Liverpool? It has been done at 44 shillings a quarter, and it is to be considered whether this price can be maintained as a rule, or whether it is liable to be increased or decreased. Now let us turn to the American wheat lands and their probable future.

Mr. Williamson, M.P., a large grain merchant of Liverpool, considered it necessary in connection with his business to visit the American wheat-lands, and discover the cost of production, and what was to be expected from the competition of this wheat. He went from San Francisco to Wala-Wala near the Sierra Nevada, and found the most astonishingly fertile region that any one could imagine. There was a stretch of wheat-fields running eastwards to the Blue Mountains as far as the eye could reach on all sides. The whole expanse was covered with wheat, and he found that the average produce was 32 bushels to the acre. The country is almost unknown and untrodden, and will produce wheat in illimitable quantities. It is sold on the spot for less than 2 shillings a bushel, but the cost of carriage to the coast is so high that until greater railway facilities are given we have not too much to fear from this region. But even at present the farmers make a living without getting rich, and doubtless the country will be opened out in time, when its wheat could be sold in Liverpool for 35 shillings a quarter. It is capable of growing 100 millions of bushels of wheat per annum if there were facilities of transit, and the soil is such that wheat has been grown for 22 consecutive years with a steady yield of 30 to 35 bushels an acre on 10 to 12 feet of alluvial black soil which is inexhaustible. Add to this, the attractions of a climate where peaches and grapes ripen in the open air, and we may easily infer the future of this happy valley. In the Sacramento Valley, 200 miles by 40 miles, the soil is extremely rich, the climate delicious, and the cost of cultivation a bagatelle. They don't require to put up the wheat into sheaves; they take the ears of corn and put them into a pile in the middle of the field, where they are threshed; and the wheat is put into sacks for shipment. The straw is burnt or trodden down by hogs or cattle. The corn may remain ripe in the field six weeks or two months until the farmer can overtake it, and he does not incur a great deal of expense through changeable weather. The consequence is, that the cost of production in California is extremely cheap; almost cheaper than in any other part of the United States. The wheat is shipped to England, and would cost 40 shillings a quarter. The Red River Valley is as flat as a table, no trees except on the banks of streams; the land is easily cultivated; the soil is good, not very deep, and nothing to compare with California, but excellent soil two feet deep and possessing great capabilities. The part of the valley in Minnesota is the best, and has the advantages of two markets, one at Chicago and the other at Minneapolis, where the great flour mills are built. Mr. Dalrymple's farm is in this valley, and his operations are gigantic. He commenced with 5,000, and now farms 30,000 acres, and on an average he has 22 bushels to the acre, which costs only 12 shillings a quarter to grow, although the small farmers cannot grow wheat at less than 16 to 20 shillings a quarter. The carriage to New York and thence to Liverpool costs about 13s. 6d. a quarter, and the commission charges and handling may be put down as 3 to 4 shillings a quarter. Red River wheat can thus be put down at Liverpool for 30 to 35 shillings a quarter. Mr. Williamson had a preconceived notion that American wheat could not be grown for less than 44 shillings a quarter. But he frankly admits that after he had been in those fertile valleys and had travelled over California, Oregon, Wala-Wala, and the Red River, he was convinced that they could produce enormous quantities, and that the English farmer has no chance with regard to wheat, although there was a great field before him in dairy produce.

The wheat in America is of two kinds—the spring wheat is supposed to be inferior to the English grain; the fall or autumn wheat is undoubtedly better than the spring wheat, and would equal or surpass home-grown wheat. Mr. Pell, M.P., and Mr. Read, who were sent to America to examine and report upon the farming competition of America for the Agricultural Commission, travelled over a great part of the States, and gave their opinion that wheat is giving place to maize in the older States, but that it is extending rapidly in the vast prairie lands of the north and west, where the average return of late years has been 20 to 30 bushels. There is an enormous tract of prairie yet unbroken, which will be devoted almost exclusively to wheat, which is the first crop they grow. Wheat is more or less being abandoned in the older States, because they cannot stand the competition with the prairie lands, and its successful cultivation depends more upon the season than on tillage. Besides, as population increases in these parts, there is a greater demand for dairy and vegetable produce, which is more profitable; and as the soil is getting exhausted, wheat cannot be grown except in rotation and with the help of manure, which increases the cost of cultivation and makes it impossible to compete with the prairie wheat, which can be grown for many consecutive years without manure or any sensible decrease in the yield. Maize is preferred in the old States, because the return depends upon tillage, and is therefore more certain, and it serves to fatten pigs. In the prairies they cultivate, on strictly economic principles, the greatest area which can be cultivated under proper supervision, and employ machinery admirably suited to their purpose. The ploughs are perfectly adapted to the land, and their reaping machines are remarkable. They have machines for gathering the wheat and self-binding with wire, but they can now do it cheaper with string; it is a perfect machine, and makes a difference of two or three bushels saved in waste where men are employed. Mr. Dalrymple, who owns the 30,000-acre farm, takes advantage of the splendid climate, and does not make his corn into sheaves, and saves the expense of building them into stacks. He uses an automatic reaper, and lets the wheat lie until it is carried to the threshing machine, and thence to the granary or elevator, as it is called, at the railway station, where it is sold, and sent off at the rate off 1,000 bushels a day, which is something extraordinary. The climate is almost always to be depended upon, and the cultivation is exactly suited to the land. Light ploughs and double ploughs on wheels are used, which get over something like 3½ acres a day. One man may look after two ploughs with three horses each. Mr. Pell says: "I saw him start; he left his own team and jumped on to the seat of the first plough, got it into the furrow and started, and then turned back and got to his own team, and followed as quick as he could. The shot of that man's work was a mile long, and I waited until he got to the end, and saw him jump off within 40 or 50 yards of the end of the shot, and get upon the leading plough, which he turned at the end, and then he ran across to his own plough, and so got back again." Then besides the advantages of climate and the ease with which immense areas of stoneless plains can be cultivated and harvested with the best possible machines and at the lowest cost, the whole object of the railway companies in the Western States is to accommodate the farmers. In England the object is to accommodate the traffic between large towns, but in America the first object is to develop the land, and directly the line is built an elevator will be put up, and a water tank, and very likely a saloon, and at that elevator will be some representative of the great merchants who announce "Cash for wheat." With all these advantages on boundless farms the statement of the Americans themselves that they can grow wheat at 12 shillings a quarter, is not improbable, but allowing for exaggerations, it may be accepted as certain that they can grow it and deliver it at the nearest railway station for 18 or 20 shillings a quarter. The wheat trade centres at Chicago, and the carriage from the farms to Chicago, which may be a distance of 400 or 500 miles, is put down at 6s. 8d. a quarter, while the carriage from Chicago to New York, which is 1,000 miles, is only 5s. 2d. a quarter. At present there is no railway competition west of Chicago, but in a short time, considering the rapid rate at which the country is being settled, this high charge for carriage to Chicago will decrease. Add the freight to Liverpool, 5 shillings a quarter, and commission charges, and wheat may be put down in England at 40 shillings a quarter; and as it has been sold for some time at 44 shillings, it will be seen that this price gives a substantial profit to the trade; and by cheapening the carriage, for which there is room, wheat can be put down at 35 shillings, or even at 32 shillings, which is the lowest estimate made. Mr. Pell does not believe these low figures will be reached, but he frankly admits that if he were going to farm land in England, he would calculate upon wheat being 42 shillings to 44 shillings a quarter. Obviously the English farmer has no chance with wheat, and farming must be entirely revolutionised to meet the competition of America. And India, if she is to retain her present position in the English market, and still more, if she is to improve it, must be prepared to encounter American enterprise with similar methods—railway development, reduction of rates, and greater economy in the handling of the grain between field and port.—*Bombay Gazette*.

THE ANTISEPTIC ACTION OF SPONGY IRON.

In a letter to the *Journal of the Society of Arts*, Mr. Jabez Hogg says:—

Dr. Bischof, in his communication of last week, says, with reference to my letter on "The Chemical Analysis of Water" of the 9th instant:—"Mr. Jabez Hogg renews a discussion which it might have been expected was carried far enough at the Institution of Civil Engineers to prove that he made a mistake." I am quite unable to discover the "mistake" he alludes to, and there certainly was no mistake on my part of the utter failure of the spongy iron filter to kill, or, as Dr. Bischof puts it, "destroy the germs of putrefactive bacteria, and possibly those of epidemic disease." My experiments, performed with due care in every way, show that the spongy iron filter will not destroy infective germs, and I must confess that I entirely fail to see the relevancy of the preservation of butter, which he imports into the question, with that of "the chemical analysis of drinking water." It is a well-known fact that butter and animal substances, if preserved from atmospheric contact, can be kept sweet for a lengthened period. I repeat what I said at the meeting of the Institution of Civil Engineers, that my experiments were conducted with great care and with a desire to form a perfectly honest opinion as to my results and no more. I have since repeated my experiments with every precaution, and upon a specimen of water, sent to me from Antwerp, collected under chemical supervision, and at this cold period of the year, the temperature of the water being only 38° Fahr., and these have also broken down under the gelatine and microscope tests. I am perfectly justified, then, in concluding, it is not because Dr. Bischof tells us that it is the object of the spongy iron filter "to destroy certain specific poisons," that the spongy iron filter will actually accomplish this, and secure a constant supply of drinking water.

The spongy iron filter does exert some chemical or mechanical action in water; nevertheless, like other filters, it is only to be actually depended upon for separating the coarser matters suspended in water—and which are, for the most part, harmful—from those that are finer and, probably, more dangerous. This will naturally impart a bright and brilliant look to almost any water; but water so treated may yet contain the germs of death, and arrangements, devised with the best intentions, for their complete exclusion will not avail much, as the seeds or germs of bacteria are so minute and impalpable that they are carried about by every breath of air, and a single drop of water is sufficient to start them into life. Water is their natural habitat; in it they live and multiply to an almost incredible extent. What then can we expect "common sense" to do for us in guarding filters in daily use against re-infection? These specific poison germs exist in the extremes of cold and heat of strong anti-corrosive fluids; why then does Dr. Bischof expect spongy iron shall kill them? A saturated solution of carbolic acid, although apparently effective for the destruction of some forms of micro-organisms, will not destroy the germs of a specific bacilli. Indeed, some of the latter, after immersion for a month in fuming nitric acid, I have discovered very little the worse for confinement in their new and extraordinary conditions of life.

Dr. Bischof employs, he tells us, "covered reservoirs," both in Antwerp and London, for the purpose of preventing re-infection by suction, during filtration of the water. Does he seriously believe that covered reservoirs will remove all chance of infection by atmospheric contact, for all time, and during each stage of his water filtration? I fear he will not gain much by his covered reservoirs.

What, then, is the proper course to pursue? That which I have so often recommended. We must draw our water from natural sources, which are neither contaminated nor contaminable. Our only security is resort to deep wells; and the drinking water of communities and individuals should only be taken from such sources. In London this could very easily be accomplished, as within a circuit of thirty miles there are 100,000,000 gallons of pure spring water running to waste. Here, then, is the remedy against pollution; and a bountiful supply, supplied by nature, for all culinary and drinking purposes. Why should London be debarred from tapping this source of pure and wholesome water?

One last word with respect to spongy iron filters. I notice that spongy iron exerts a *de*toxidising effect upon water; and, also, on standing a glass bottle of filtered water by for a few days, a considerable deposit of red oxide takes place. There is, probably, no great harm to be apprehended from the latter; but water bereft of its oxygen, is neither very palatable nor perfectly wholesome. For this reason it becomes absolutely necessary once more to restore this important element—oxygen—to spongy iron filtered water, and this is done at the Antwerp water-works.

It is now placed beyond a doubt that all the various processes adopted by chemists, more or less, miss their mark. They all, indeed, destroy without discovering the more pernicious micro-organisms contained in their specimens. This I have insisted upon and pointed out, and it has been once unmistakably demonstrated by the Medical Department of the Local Government Board. Dr. Cory has directed a series of experiments which clearly prove that a chemical examination will not distinguish between an excremental pollution of water and that taken from a pure source; so "the lesson is taught us afresh and significantly, that while we must ever be on the watch for the indications that chemistry affords of contaminating matters gaining access to our waters, we must go beyond the laboratory for evidence of any drinking waters being free from dangerous organic pollution. The chemist can tell us of impurity and hazard, but not of purity and safety. For information about these we must go, with the aid of what the chemist has been able to teach us, in search of the conditions surrounding water sources and affecting water services."

CACAO.

Cacao Cultivation in Trinidad.—In the first half of 1882, the exports of cacao had risen to over ten millions of pounds against an average of eight millions, and the *Trinidad Chronicle* states:—"The laying out of new land in cacao goes on unceasingly, as it has been doing over the last 12 or 14 years, the great majority of the plots, small at first, owned by small people *ci-devant* labourers and contractors, and cultivated by themselves, but by degrees forfeited to the merchants to whom they are indebted for advances, and by amalgamation converted into good-sized properties counting acres by the hundred and (the cacao) trees by the tens of thousands. There is no movement corresponding to this in cane; and the opening of cane estates on any scale—and a large one, *ab ovo*, is the rarest of *rara avis*—goes on slowly indeed. It cannot be done without capital, a capital of thousands sterling, while a very small purse of savings will give a man courage to buy and lay down, in cacao and provisions, a little plot of ten or twenty acres. Yet it is pleasing to note that where a new line of road cuts through virgin land, as at Counpia, by the railway, buyers start up from the ground as it were that no one dreamt of, men in the town successful in business or trade whom no one had previously credited with a taste for cultivation, yet who, on being tested, have been found to be gifted with a somewhat Mechian capacity for the pursuit quite equal to, and in some respects possibly better, than old clod-plodders to the manner born, carrying into the new practice the habits of foresight and perseverance that had gained them their first successes, and yielded them the means to enter on an untried venture."

EXPERIMENTS IN COCOA CURING.

[The following letter, addressed to a cocoa planter, has been placed at our service for publication.—Ed, *Times of Ceylon*.]

Colombo, April 2, 1883.

Dear Sir,—I have to apologise for having delayed so long my promised report on the experiments I made with cocoa pods you were so kind as to place at my disposal; one thing or another came in the way of my putting the results on paper. Your letter of the 31st ultimo hastens, by a few days, the letter I intended to write to you. One of the chief objects I had in view in asking you to lend me some cocoa pods was to ascertain whether I could hasten the process of fermentation, by the application of a regular and constant higher warmth, than that of the atmosphere. I am sorry to say that all my experiments in this direction were complete failures; the result, therefore, is, that instead of preserving the pink colour of properly fermented beans, all I experimented with are very dark and coated, so far as the outward appearance is concerned. I attribute this complete failure in a great measure to my previous unacquaintance with the ordinary process, as also with the nature of the mucilage to be dealt with.

I found that if the whole of the mucilage was not got rid of, what was left immediately turned black by exposure to the atmosphere and very quickly got mouldy. All this of course you know, and I only mention it as an explanation of my failure in the object I had in view. But if the result of my experiments was unsatisfactory in one respect, it was satisfactory in another; it proved to me what you no doubt know, but which I did not, that fermentation of the beans is only practised for the purpose of removing the mucilage, that process being perfectly unnecessary for imparting the true chocolate color to the cocoa kernel, this being developed, in the course of drying the beans, by the conversion of the watery juices of the kernel into the colouring oil, which forms so large a portion of the cocoa bean. The satisfactory point ascertained by the experiments is, that not only may the whole of the mucilage be got rid of without any fermentation whatever, by a very simple and easy process, but the mucilage itself can easily be converted into a valuable product, instead of being wasted as by the present method.

I found by experiments that considerably more than half of the mucilage may be separated from the beans, by washing them, or rather mixing them, with a little water, and by agitating them in a revolving cylinder with perforated holes for the fresh saccharine liquor to run into a trough, which would convey it to a clarifyer, which is the first process towards its manufacture into sugar.

That portion of the mucilage next to the beans—especially that adhering to them—is more refractory and difficult to separate, but I found that even this could be easily rubbed off by friction. I should think a machine, similar to a washing machine, would answer the purpose on a large scale. I may mention that in my small experiments a quantity of small stones was mixed with the beans to chafe them when revolving, sufficiently to remove the whole of the mucilage, and preserve it before fermentation set in.

If cocoa planters are indifferent to utilisation of the enormous quantity of saccharine contained in the mucilage, or think the result will not compensate for the trouble, I still think a much better and speedier way of getting rid of the mucilage may be hit upon than by the slow and wasteful process of fermentation. As a half or three-fourths of the mucilage can be removed at once by simple agitation, there is only the last coating to be dealt with—this could be rubbed off by some process or other. I obtained a beautiful sample of cocoa by rubbing the mucilage off with a rough towel. However, I have no intention of suggesting any particular way of removing it. I only wish to say that I think, for the reasons given above, that fermentation is a wasteful and an unnecessarily slow process. At present my interest in this portion of the question is very insignificant.

I will now advert to the point in the curing of cocoa, in which I am particularly interested, and that is, whether the principle of my tea-dryer cannot be applied to the drying of large quantities of cocoa (which, like the produce of its palm namesake, contains so large a quantity of oil as to render it very susceptible of mildew in a damp atmosphere) until the whole of the moisture is evaporated or dried out. I believe that my tea-dryer can be advantageously used for the purpose of drying cocoa in a manner which would not injure or remove the outer skin or parchment. The result of my experiments is to satisfy me that, in the first instance, the drying should be very, very gradual though continuous, to allow of the watery juice to evaporate gradually and for the colouring oil to take its place. If dried too quickly, the parchment will split on the germinating side; the watery juice will evaporate, and the kernel become dry before the oil has permeated the whole of the kernel; the result will be that some of them will dry white or mottled, and the parchment will crack in a way that will render it liable to become detached from the nibs in transport or manipulation.

My advice then is, if my dryer is used, to spread the cocoa fresh from the process of removing the mucilage on the hot surface rather thickly, say four or five inches thick, and keep it there until the whole becomes warm throughout. I would then remove it into bags, and let it stand for a few hours until a fresh charge is ready to be put into bags; I would then replace the first charge until it again became warm throughout; by thus alternating the charges, a large quantity of cocoa could be dried gradually, which I believe to be a necessity in cocoa curing. I assume that drying cocoa by artificial means would only be resorted to when it is impossible to dry it in the ordinary way—*viz.* by the heat of the sun, this method being obviously the cheapest one, though by no means the speediest, and during the greater part of the year the climate of the mountain zone of Ceylon renders it almost impossible to sun-dry cocoa satisfactorily on the estates. For the purpose of drying large quantities, a considerable area would be required. You can ascertain the cost by taking two and-a-quarter rupees per superficial foot as the basis of calculation. The heat generated by the drying machines would, in a closed stove, with ventilators, hasten the drying of half-dried cocoa, and prevent mildew and discolouration.

In communicating the results of my crude experiments, I desire only to turn your thoughts into the channels I have indicated. I have not the materials for continuing the experiments, nor can I afford either to buy them or the appliances for doing so. You will, however, be able to continue them on the hints I have ventured to offer.—Yours truly,

C. SHAND.

P. S.—As the oil in cocoa beans liquifies at 120 degrees, the process of colouration is hastened by drying gradually on a surface heated to 170 degrees.

FORESTRY.

ANIMALS AND FOREST TREES.—A correspondent writing from Johnsonville, S. C., incidentally mentions a curious instances of the influence of animals in controlling or preventing forest growths. It appears that the fondness of hogs for the juicy roots of young pines leads them to seek them assiduously, so that where hogs are allowed to roam in that region, one can hardly find a young long-leafed pine in a thousand acres of pine forest. There being no young trees to take the place of the old ones used up by the lumbermen and turpentine gatherers, that species of pine timber is rapidly being exterminated.

FOREST TREE PLANTING.

THE planting of trees for ornament and shade, as wind-breaks, to preserve the natural area of forest, to ensure the best results from the cultivation of farm crops (not less than one-tenth of the area of a farm), or for the purposes of useful timber in prairie regions, is now admitted by all thinking men as among the indispensable industries connected with farm life. That forests do modify climates there is no longer doubt. That belts and clumps of trees largely mitigate the force of winds, and prevent the recurrence of those disastrous storms called blizzards, that periodically sweep over open districts of country, is capable of demonstration. That forests and groves hold the water of rains, giving it up slowly, is beyond cavil. That forests prevent the recurrence of our great river floods, however, is only true in a sense. The absence of forests do intensify floods. They rise faster and decrease faster. Germany contains more forest area to-day through careful planting than it did 25 years ago. Yet it did not save that country from the great floods of 1883, the most severe on record.

The terrible flood of February in the Ohio, and consequent destruction of life and property, will long be remembered. That it was intensified in its suddenness is undoubtedly due to the cutting away of forests on the western slopes of the Alleghanies in New York, Pennsylvania, and West Virginia. This rise exceeded the great flood of 1832 and 1867 by only a few inches, but these few inches represent a vast surplusage of water as against medium and high water. It is idle, however, to say that the owners of mountain lands hundreds of miles away from the principal scenes of devastation, will be deterred from the cutting of timber thereby. It is present profits they are looking to, as are other men. The great forests are gone, but the great area is still covered with underbrush, as valuable as mature trees so far as covered areas are concerned. What the owners should be made to understand is that the planting of these slopes to valuable varieties of timber is the most economical use that can be made of such rough sections of country. This accomplished, the difficulty will be obviated and a fair preservation of timber will be secured.

Hoop poles are among the most necessary and valuable of young timber growths. A plantation made thick enough will in a very few years yield these by the natural thinning required. As the years pass, the subsequent thinnings are none the less valuable, as props to mines, that must be constantly renewed, posts, railway ties, &c., until at length the trees for mature growth will stand two or three rods apart as the case may be, and of just the varieties adapted to soil and situation. The difference between a piece of natural timber and a piece of planted timber lies in the fact that the natural timber contains far more timber of low value than of timber valuable in the mechanic arts. The planted timber is all valuable. Here is where the profit comes in, demonstrated beyond doubt in Europe and now capable of demonstration in this country. Let any farmer figure for himself. He will acknowledge that a grove will pay for planting in the protection it gives. Let him figure the actual value of such a plantation at 20 years of age, the trees averaging 12 inches through of black walnut, ash, catalpa, black cherry, larch, pine, spruce, or any of the valuable timber trees, standing 20 by 20 feet apart, or 108 to the acre, half of which may now be removed with advantage to the rest. It would amount to a large sum, and those left would be a sure source of income to his children if not to himself. It is not necessary to follow the matter farther. Any observing man may figure for himself that the profits are not less than in any of the other branches of common husbandry.

Let us now figure what to plant and how to plant. If simply for shade and roadside trees, elms, maples, and walnut among the slower-growing varieties, and cotton-wood, linden, catalpa among the faster growing varieties. For shelter of buildings and wind-breaks, Norway spruce is undoubtedly the best, though any of the evergreens may be used.

It is better to plant the seedlings of evergreens as grown by nurserymen for the purpose. The transportation is light and the seedlings may be thickly placed—one foot by three inches in the row. As they begin to crowd, take out every other plant, and again every other one in a row, and these will be all right for wind-breaks, &c., while the remaining plants now standing 12 inches apart, will be available for single trees to develope into their full beauty. The seed of deciduous trees should be planted pretty thickly in rows four feet apart as early in the spring as the soil may be worked. Nuts should be kept in moist, well drained sand during the winter, and if they freeze slightly they are none the worse. As they grow, thin out to about three inches in the row, transplanting to any weak places, and thin from year to year for planting out until the trees stand four by four feet. Here they will make nice trees for transplanting at the proper time, or for thinning out as required for poles, posts, &c. All small seeds as maple, linden, &c., should not be covered more than one and-a-half inches. Nuts should be covered three inches, and these latter may be dropped in the row about three inches apart. All the nut trees should be planted where they are to grow, but with care in root pruning at one year old, they may be transplanted at two years. To plant large trees the holes are better made in the autumn. Then when the soil will work friably, dig them with as much earth as will adhere to the roots; do not allow the air to have contact with the roots more than can be avoided. Evergreens we have known killed by exposure to the sun or dry winds for a few minutes. When the tree is placed in the hole so that the collar will be little, if any, lower than—as it heretofore stood—the surface, throw in the finest soil, packing firmly about the fibrous roots; when the roots are well covered, press all firmly with the feet, being careful, however, not to scrape or bruise the roots. This firming is absolutely necessary. If the soil is dry, saturate with water, and cast over all where it has dried away the remainder of the earth, levelling all smooth, and stake if necessary.

Mr. Robert Douglas, of Waukegan, Ill., who certainly understands forest tree culture, in relation to planting forest trees over large areas, says:

"In order to establish the fact that forests can be successfully planted without the aid of experts, we took three contracts. Two of these plantations are in Crawford County, Kan. We have already planted 500 acres on these two contracts, and will plant 500 more acres before the first day of May next. These trees are planted by ordinary labourers, superintended by a man who never worked a day in a nursery. They are planted with spades, and stand four by four feet apart, the ground having been marked out the same as for corn. One man or boy holds trees for two planters, and the three together average 4,500 trees planted in a day of ten hours. We plant 2,720 trees to the acre; our contract calls for 2,000 trees; they stand over 2,500 to the acre.

They consist of three-fifths *Catalpa speciosa* and two-fifths *Ailanthus*. The catalpas three years planted stand from six to ten feet high and two to three inches in diameter at the collar, shading the ground so as to need no further cultivation. On the richest land they shade the ground after being two years planted.

As these trees are planted by farm hands and cultivated with common corn cultivators, it proves that any farmer who can raise an acre of corn is competent to grow an acre of forest.

ARTIFICIAL PLANTING FOR PROTECTION.

DR. JOHN A. WARDER, in a late number of the *American Journal of Forestry*, in an article detailing the work of planting certain portions of a large tract of land in Iowa, under the direction of Mr. Jesse W. Fell, well known for his efforts in tree-planting and tree culture, at Normal, Ill., concludes the article with some general remarks upon the effects of tree planting on climate, from which we extract the following interesting reading :—

"With a tract of land of even a few thousand acres thus planted and thus sheltered by trees to check the trying winds both of summer and winter, who that has once seen and realized the benefits of these wind-breaks will doubt the influence of trees upon the local climate, and their agency in producing and retaining the humidity of the atmosphere so essential to our crops and to our comfort or that of our cattle? Let such planting become general, and who can say that the climate of a whole region may not be measurably reclaimed from the aridity and severity that now prevails; and who will say in advance that such a covering of the surface, if carried on over still wider and more extensive regions, cannot and will not affect the average annual amount of rainfall? And yet, we are told, on high authority (Wm. Saunders, horticulturist, U. S. Department of Agriculture), that "to plant one hundred acres in trees, with the view of increasing the rain-fall on the adjoining one hundred acres of arable lands, seems to us a very weak proposition." Now, to many of us who have realized the benefit of wind-breaks on the prairies, it is no longer a *weak* but a *very strong proposition*, that judicious and extensive tree-planting does and must modify the *local climate* for our benefit, and that it might well affect the annual rain-fall. Time may be necessary to eliminate the possible errors arising from cycles dependent upon cosmical causes that are not yet fully understood; but let us have credit, and let the judicious plantations of trees have the credit for their influence in modifying the local climate of the farms, townships, counties, and states, where we do know that such ameliorating influences are sadly needed.—*The Garden.*

THE PURPOSE AND PROCESS OF GRAFTING.

IT is not difficult to understand the nature of grafting. A plant differs from an animal in several respects, and one of these differences is that a part of a plant can be separated from the rest, and, when placed under favorable conditions, will live and grow. If an arm or leg is cut from a man, or an ear or tail from a cow or horse, the part separated from the main body of the animal dies. The gardener well understands, and when he wishes to propagate the geraniums or verbenas, he separates small stems called cuttings from the large plant and sets them in moist sand, when the ends first callous and then send out roots into the moist mixture, and in a short time he has a supply of plants of the same variety as the one from which the slips or cuttings were taken.

In grafting the process is much the same, only a little more complicated, and therefore a trifle more difficult to do successfully. But by this it is not to be understood that the process is one requiring any great amount of learning. In grafting, a cutting of recent growth, called a cion, is shaped and fitted into a part of another plant called the stock. Instead of being put in the sand it is placed in the living substance of a plant, and derives nourishment for its growth from the stock. In order that this may be accomplished it is necessary that the growing layer of the cion and stock come close together. This growing layer, as it is termed, is situated just below the bark, at that point where the bark slips from the wood when a whistle is made of willow or other wood.

There are a number of important things to take into consideration in successful grafting. It is not enough to be able to set a cion and have it grow well, though that is very important. Grafting is done for the purpose of improving the tree or shrub thus treated, and therefore the quality of the cion should always be superior to that of the stock for the special end in view. For example, an apple tree may be all that could be desired in thrift, healthfulness, &c., but the fruit is of poor quality or small in quantity, or both. A superior sort is grafted upon such a tree and all the strength and vigor of the whole tree is used in making a good kind of fruit. Therefore, after deciding to graft a tree to improve it, one should be sure that the cions are of excellent quality. A tree may be made poorer by grafting as well as improved; in other words, there is no benefit to be derived in itself from the process of grafting.

The cions may be bought at most nurseries. If cut at home be sure that they are from well-known trees. Twigs of last season's growth only should be used. If more than one variety are used, tie up in bundles and keep separate with labels on each package. The twigs thus cut should be put in moist sawdust or moss, and kept in a cool place until needed.

The implements needed in grafting are a fine saw for cutting off the limbs, a large knife and mallet for making the clefts, and a small, sharp knife, to be used in cutting the cions to proper shape. A wedge will also be needed for opening the cleft made in the sawed end of the stock. Grafting-wax, to protect the exposed surface from the weather, can be easily made from the three substances in the following proportions: Beeswax six ounces, rosin and tallow four ounces, melted together in a kettle, over a fire. Old cotton cloth, torn in strips, is waxed with this while melted and wound on sticks ready for use. This cloth is bound around the grafts after the cions have been set, care being exercised not to move the cions in the operation.

It has been stated above that it is not difficult to understand the nature of grafting, neither is it difficult to perform the operation. Any one with a small amount of that indescribable mental power called "gumption" can soon learn to graft. It is largely a matter of practice to do the work quickly and well, after the simple principles involved are once understood.

The time to graft is when the buds begin to swell. Having determined upon the place to graft, saw off the limb and, placing the large knife across the sawed end of the stock, strike it gently with the mallet, and thus make a cleft for the cion. With the small, sharp knife cut a piece from one of the twigs in the bundle so that it will bear two or three buds, shapen the lower end into a wedge and insert this end into the cleft (opened by a knife) so that the growing layer will come against that of the stock and be bound there. This is the all-important point in grafting, and if not done the work is lost. If the branch is larger, bud grafts, one on each side, may be set. The after-work of grafting comes later in the season.—CION.—*Farmers' Review.*

THE GARDEN.

NOTES ON CULTIVATION OF RAINY-SEASON VEGETABLES.

MOST of the vegetables peculiar to the rainy season are rank growers, and require more room than the average sized garden can spare. Those not included are not of much value, and unless variety is an object, they may be safely left to the care of the native grower. If ever required, he will supply them as cheap as one can grow them.

Kheera (cucumber), *Cucumis sativus.*—The rainy-season varieties of this vegetable are very distinct from the variety with small egg-shaped fruit cultivated during the hot season. Two varieties are common in India, although, as far as flavour is concerned, there is little to choose between them. When in a young state the colour of one is a dark green, and of the other creamy-white. When full grown both are about a foot long, and the colour changes to a rusty brown. These two, although not equal to the commonest varieties met with in England, are not to be despised. They thrive with little care, and are always sure of yielding a crop. I annually try some of the English varieties, but have never been able to ripen a single fruit. They sometimes form, but invariably rot before attaining maturity.

In order to have them in use all through the season, three sowings should be made—the first in April, the second in May, and the third in June. Rich soil should be selected, and the seeds sown in lines five feet apart. When the young plants are about four inches high, supports should be given for them to climb on. The first sowing should be regularly watered, until the rains begin. Afterwards none need be given unless a break of more than ten days' duration should occur.

Kali Turai (*Luffa acutangula*); *Ghia Turai* (*Luffa ægyptica*).—These two vegetables require the same mode of cultivation, and may therefore be described together. When full grown, the fruit of the first-named is about a foot long, and of an angular shape. When cut for use it should never exceed four inches in length. If cut when longer, it is quite useless for the table. The fruit of the second is about 6 inches long, dark green, and slightly spotted with creamy-white. It must also be cut when quite young.

Two sowings of both will keep up a supply from July until October. The first sowing should be made in April, and the second in the end of May or beginning of June. The seeds should be sown in lines at the same distance apart as cucumbers. The general treatment required is the same as described for the latter, and need not be again detailed.

Chachinda (Snake-gourd); *Trichosanthus anguina.*—The fruit of this vegetable is from one to three feet long, and of a very handsome appearance. When young they are beautifully striped with white and green, and when ripe change to a brilliant orange. The young fruit is used as a substitute for French beans. When cut up into thin strips and boiled, they form a fair imitation of that vegetable. Like the *Kali* and *Ghia turai*, the fruit must be used when very young. If cut when more than 4 inches long; they often have a very bitter taste.

Two sowings should be made, the first in April, and the second in May. The distance apart and general treatment is also the same as described for cucumbers, and need not be again detailed.

Kurraili (*Momordica charantia*).—This, although botanically the same species, is a different variety from the one grown during the hot season. The natives of this district call the hot-season

variety *kurraila*, and the rainy-season one *kurraili*. The former variety does not require any supports to climb on, but the latter does. The fruit of both is much alike; however, the rainy season variety is, on the whole, smaller.

One sowing is enough to make of this vegetable. If this is done in the beginning of June, it will keep up a supply all through the rains. It also requires the same treatment as the cucumber.

Al Kudu (*Laoki*); *Lagenaria vulgaris*.—The fruit of this vegetable, if cut when quite young, is nearly equal to the vegetable marrow in flavour. Its size and shape varies very much. Some varieties are nearly a yard long, and others are compressed into short club-shaped gourds, not above a foot long. The flavour of all are nearly alike, and it is of little importance which variety one may possess.

It can be sown as early as February and as late as July. However, for rainy-season use, two sowings should be made, the first in April and the second in June. The first sowing will be ready for use in the beginning of the rains. The second will come in about the middle, and keep up the supply until the cold season. It can be sown in nurseries and transplanted, or sown at once where intended to be grown. The latter mode is preferable, but if an empty plot is not available when the sowing season arrives, it is better to adopt the first named, than let the sowing season slip past. It succeeds best in heavily manured sandy soil, but will thrive ordinarily well in any. When sown or transplanted, the seeds or plants should be inserted in patches 6 feet part. No supports are required as it prefers to trail along the ground. It should be weeded when necessary, until the patches interlace and cover the ground. Afterwards it will not require to be touched, as the dense network of branches will keep down the weeds.

Kudu (Pumpkin); *Cucurbita maxima*.—There are several varieties common in gardens. The commonest one is a large globular gourd, and of a brown colour when ripe. If cut when about a pound in weight, their flavour resembles that of the vegetable marrow. It is also very good if used when full grown.

The seeds should be sown from April to June. It is a gross feeder, and requires very rich ground. The distance apart and general treatment is the same as described for *Al Kudu*, and it is needless to detail it over again.

Bhuta, *Maka*, (Indian-corn,) *Zea Mays*.—The cultivation of this plant requires little care. There are numerous varieties in cultivation. It is a popular plant in America, and of late years that country has raised a large number of improved kinds. Although much superior to the varieties cultivated in this country, they cannot be depended on to produce a crop on the plains. For ordinary garden cultivation, and where a supply of corn-heads is the first consideration, it is better to grow the indigenous varieties, and leave the American kinds to the care of the experimentalist.

In order to have a supply of the green unripe heads of corn all through the season, it should be sown at intervals of a fortnight. The first sowing should be made about the middle of May, and the successional sowings continued up to the middle of July. The seeds should be sown in lines 15 inches apart, and 12 inches between each seed. When the plants are a foot high, they should be earthed up like potatoes. If the soil is rich and heavy, they will succeed very well without this being done, but if poor and light, the operation is very beneficial. It brings a greater supply of food within easy reach of the roots, and also lessens their chance of being blown over during storms.

Bhindi (*Hibiscus esculentus*).—This is a very wholesome, although not a palatable, vegetable to every one. The fruits, when cooked, are very slimy, and for this reason many do not care for it. Those who do not consider this an objection, find it palatable, and as it is easily managed, a few plants are not out of place in a garden.

It should be sown from April to June. One sowing is sufficient for keeping up a supply all through the rains. It should be sown in nurseries, and when three inches high, transplanted in lines two feet apart, and 18 inches between each plant. It will also succeed fairly well if sown at once in the plot where intended to be grown, but succeeds better if transplanted. It should be regularly weeded all through its period of growth. The oftener done the better, as frequent weedings keep the surface soil loose and open.

Lobia (*Vigna catiang*).—This is an annual plant with narrow pods from 6 to 12 inches long. It is one of the most useful of the bean tribe for rainy-season cultivation. There are many varieties of *saim* (*Dolichus*) cultivated during the rains, but as hardly any of them are ready for use until the cold season, I have excluded them from this paper.

This species should be sown just before the rains, and will be ready for use about the middle, and continue until the beginning of the cold season. The pods should be gathered when about six inches long. If gathered when longer they are tough and stringy. It should be sown in lines four feet apart, and treated in the same way as cucumbers.

—*The Indian Forester*.] W. G.

NOTES AND GLEANINGS.

NEW ROSES.—Among new roses shown by Messrs. Wm. Paul at the May meeting of the Royal Horticultural Society were four fine varieties named Mdlle. Marie Gurnier, deep rose; Violette Bouyer, blush; Camoens, fleshy crimson; and Queens of Queens, pale rose. All those had large and full flowers, except Camoens, which was remarkable only for its pretty colour. Mr. H. Bennett, Shepperton showed a n w hybrid tea rose named Duchess of Albany. It is large and full, of a pleasing soft pink hue.

POT ROSES.—On the above occasion also, a grand display of pot roses was made by Messrs. Wm. Paul and Sons, of Waltham-cross Nurseries. They consisted of about half-a-hundred well-grown plants, including some of the finest sorts, such as Marie Baumann, Mdlle. Marie Rady, François Michelon, La France, Juno (a fine plant). The snowy whiteness of the fine blooms of Mabel Morrison contrasted beautifully with the rich deep velvety crimson of the superb Duchess of Bedford, a Waltham Cross rose, and one of the best of new roses of recent years. Among other roses raised by Messrs. Wm. Paul and Son were Masterpiece, bright rose-crimson; Lady Sheffield, a glowing cerise, the blooms large and fine in shape; Star of Waltham and Little Gem, a pretty new moss rose with compact rosette-like blooms of a rosy cerise. This group of pot roses was supplemented by half-a-dozen boxes of cut blooms equal in quality to those which one sees in July. Among them a large tray of about three dozen blooms of Magna Charta, showing that superb rose to perfection; noteworthy among the others were Paul Verdier, Princess Marie Dolgorouky, Beauty of Waltham, Duke of Wellington, Crown Prince, and Dupuy Jamain, all of which are excellent for early flower.

PYRETHRUMS.—From time to time we have mentioned pyrethrum as plants deserving the attention of colonial growers. One of the wild species is the source of the Persian insect powder, but hybridists have expended much skill and time in raising a race of double varieties, and they have succeeded in their task to perfection. At their meeting on May 9 the Royal Horticultural Society awarded the silver Bauksian medal to Messrs. Kelway and Sons, Langport, for a grand collection of these beautiful hardy flowers. "About 50 double kinds were shown, and about a score of single sorts. Among the latter there were some beautiful flowers, varying in colour from pure white through pink to the deepest crimson. A selection should include Romulus, Demo, Themis, Rusticus, Melon, Damia, Dyris, Dacius, and Carbo. A representative selection of the doubles are, among crimsons and pinks, J. N. Twerdy, Sefton, Nemesis, Progress, Gloire d'Italie, Hobart Pasha, Duchess of Edinburgh, and Captain Nares; and among light-coloured kinds, Niveum plenum, Album roseum, Mont Blanc, Vance, Cleopatra, and Solfatterre."

LAPAGERIAS.—These finest of greenhouse climbing plants are to some extent exceptional in their requirements. If grown in houses where any warmth is used further than is sufficient to keep out frost they are excited to earlier growth, and under such circumstances I have found the young shoots and leaves very impatient of exposure to the full force of the sun, which not unusually has the effect of stopping the shoots from attaining their full growth, and causing the leaves to be deformed. Any aspect seems to suit these plants better than the south, yet if in too dark a position they rarely flower, however strong they may be, so freely as when more favourably placed in this respect. Now, whilst the young growth is in its tenderest condition, a thin shade of some kind should be applied and the soil should be kept well moistened, especially if the plants are grown in pots or tubs, and the roots fully occupy the soil; but where small or medium sized examples have been recently turned out in beds of considerable extent the earth must not be made too wet, otherwise it will get into a soddened condition, under which the plants do not thrive. Syringe every afternoon, getting the water if possible well to the under sides of the leaves; if this is attended to regularly, thrips, to which these plants are so subject, will be kept down, an essential point, for though the hard texture of the leaves prevents their being killed outright, still the insects feeding on them shorten their duration—a sad mishap when used for covering back walls and similar places in conservatories, for which purpose lapagerias are well adapted.

LILACS.—The varieties of these are numerous, but only about half of the number that have been named can lay claim to distinctness, the shades of colour, the chief distinguishing character in many of the kinds, being remarkably alike. The majority belong to the common lilac (Syringa vulgaris), and it is a remarkable fact that there are comparatively few varieties of the Persian lilac (S. persica). One of the very finest varieties in flower is called Prince Camille de Rohan, a kind which stands out prominently from all the rest on account of its dense panicles of blossom, which in the bud stage are a deep rosy-crimson, but lighter in the expanded state. A similar, but not such a fine, sort is one called Sinensis rubra, and next in merit is Professor E. Stockaert. Rosea grandiflora is a very fine variety, which has exceptionally fine panicles, lighter in colour than those of either of the kinds named, but very pleasing. The foregoing comprise some of the most distinct of the dark-coloured varieties Among those that are but little different from the type of S. vulgaris are those named Goliath, purpurea, rubra, cœrulea, and media. The major variety, called also Charles the Tenth, is well known. It is an excellent kind for forcing, and should be included among the best of the dark varieties, as should also the double flowered sort, which possesses the advantage of remaining in flower longer than the rest. The best of the pure whites is Ville de Troyes, which is much superior to the common white (S. vulgaris alba), having larger flowers and denser panicles. Another, called Jacques Callôt, is but little different from Ville de Troyes. The most noteworthy varieties of the Persian lilac are the white (alba), now becoming a scarce plant, even in the best nurseries, and the cut-leaved variety (laciniata), an elegant shrub called also pteridifolia. The Rouen lilac (S. rothamagensis) is an extremely pretty shrub that deserves to be better known than it is. It differs from the Persian in being neater and more compact in growth, and in having narrower leaves. We found it here under its synonym S. dubia. There are a few varieties of it, the white (alba) sanguinea and Gloire de Moulins being the most remarkable. Among other distinct species S. Joiskæa, a Hungarian lilac, will shortly be in bloom, and later on the Himalayan S. Emodi, also very distinct from any of the commoner lilacs.—*The Garden*.

SERICULTURE.

A CORRESPONDENCE writer :—"The extension of *tussar* sericulture in North India is not yet to be despaired of. It is true that natives here know nothing about the industry. It is probable that no European has yet proved that it can be made successful commercially. But considering the very inexpensive nature of the process of rearing the cocoon, that it can be done by women and children, and that the worm is indigenous to the province, it is certainly possible that the industry may be developed. In the Hoshiarpore experiments, the best plan of rearing the worm was found to be to put it out when very young on the *beri* tree in the open, and there to guard its natural enemies—crows, sparrows, and, worst of all, wasps. In order that the trees on which worms are put may be properly watched, they must be kept of a moderate size, and planted close together. The watching can be done by, children. Sometimes more than a hundred cocoons have been taken off one small *beri* tree. The worms strip the tree of its leaves, but a young *beri* will send forth a second crop of leaves the same season. The rearing of the worm could then be conducted with almost no expense to the cottager. But it involves the trouble of careful watching, and the moths have to be caged to ensure a supply of eggs. The conditions of successful rearing have been approximately, but not fully, gauged. A large number of cocoons are annually reared in the jungles by the wild tribes in Central India and some parts of Bengal. Did Major Coussmaker try rearing in the open, on trees of moderate size planted together? It would be interesting to see details of his experiments."

SERICULTURE IN NEW ZEALAND.

MR. WILLIAM COCHRAN, writing to a contemporary regard. the suitability of New Zealand for Silk farming, has the following :—Passing over the unanmious verdict of the Press in favour of silk farming as likely to form a pleasant and remunerative employment for women and children, besides helping to add materially to many a cottager's income during periods of commercial depression, I come to a paragraph which must be quoted intact:—"In the United States, for the introduction of new and valuable industries, or the development of any which already have a footing, there is a lively public spirit, and as a consequence thereof the promotion of such enterprises is part of the business of Government. A special department of State is devoted to the purpose, and anybody wishing to embark in this line or proffering suggestions or co-operation is not snubbed as an enthusiast, but can rely on getting full and practical information for his guidance, and State aid also when necessary and proper."

The great importance and value of the silkworm eggs trade forms a feature of which the Colonial Press takes due note, amounting, as it does, in the case of Japan, to three million sterling per annum. It is argued that as no disease of any kind has yet appeared in the province of Canterbury among the worms, as last year's harvest extended from September 1881 to June 1882, and as the white mulberry grows with great luxuriance notwithstanding late and sharp frosts, the sericulturists there should confine their efforts mainly to egg production. As an illustration of the happy effect that climate exercises on imported eggs, it is mentioned that cocoons, moths, and silk lately raised from *graine* brought from Japan and Victoria admitted of no comparison with the foreign article. The New Zealand-bred cocoon, to use the language of the Colonial newspaper, "is heavier, firmer, and by a great deal larger than either of the others; the New Zealand moth looks capable of swallowing the little Victorian moth and asking for more; while the Australian and Japanese silk is far behind ours in strength, evenness, and gloss." The *Press* of Canterbury, on January 20th, notices "some very beautiful specimens of raw silk prepared from cocoons, obtained this season. . . . The samples are intended to be forwarded by the Governor to England, with the view of testing practically the capabilities of New Zealand as a silk-growing country. At the end of March, Mr. Federli intends to send home in the refrigerating chamber of the S.S. *British King* some *graine* to London, for the purpose of distribution in France and Italy, to test the health of the worms raised in this country."

It is stated that it requires 500 acres of cultivable land, or 5,000 acres of bush land, to produce in wool as much value as can be extracted from one acre of mulberries in the form of silk; and it should be remembered that almost on the threshold of the industry in New Zealand the cropping season, even in a frost-visited province like Canterbury, has already been prolonged to nine months, as against the three months originally calculated upon, or the six weeks of Europe and Asia. It seems to me that those facts ought to dispose of the charge of exaggeration and blind enthusiasm brought against the advocates of sericulture in New Zealand on more than one occasion by thoughtless persons in this country and elsewhere, and by one illustrious statesman in the Colony. It has been already indicated in my former letter that it is desired to promote a public company, with a capital of at least 150,000*l.*, to purchase a tract of land: for this purpose an eligible estate of under 10,000 acres has been offered at a reasonable price and on easy terms. The land is situated on the Bay of Islands within three miles of the rising town of Russell, which promises to be, at perhaps no very distant date, the future first port of call in New Zealand for the steamers of the Pacific Mail Company arriving from New South Wales and San Francisco. The estate possesses a frontage to the bay of about two miles; is bounded for about nine miles by a picturesque, tree-fringed river, fordable in only three places along that distance; and the land is intersected by several smaller streams, this promising abundance of water-power.

Such a desirable estate as this is described to be and so evidently suited for the purpose indicated, should not be allowed to revert to ordinary agricultural purposes without careful inspection by a qualified commissioner, and an attempt made to effect its purchase if found all it is painted. If these and former remarks recommend themselves to enterprising capitalists throughout the Empire, the period has evidently arrived when energetic and speedy measures should be adopted. The New Zealand Government is ceasing to be lethargic over this matter, and doubtless an influential public company once formed would necessarily command that prompt attention to its suggestions or proposals which an obscure individual need hardly expect.

NATURAL COLOURED SILK.

THE prevalent colour of the raw silk that meets the eye of the visitor to the London Docks is yellow; but there are other natural tints known, and the number might be considerably increased were the teachings of careful observation better learned and digested. Thus, we already receive pure white silk in its greatest beauty from Palestine; an almost colourless variety from the *baroo poloo* worm; nearly white silk from the *mezankooree* insect; and a delicate grey filament from the *atlas* grub—all belonging to India. China, Japan, Persia, and Sicily export mainly the golden-yellow variety, and India a similar colour in quantity in addition to those just alluded to. To these may be added the beautiful fawn-tinted silk of Northern China, obtained from a gigantic worm which feeds upon the leaves of the mountain oak, but will not refuse those of the mulberry when offered; and the pearl-grey produce of the *Attacus cynthia*, fed upon the leaves of the ailanthus, and now successfully reared both in France and parts of England. If we eliminate the pure white and grey (which can scarcely be regarded as colours) from this list, yellow in various shades is really the only decided hue at present possessed by the raw silk of commerce. With the knowledge of the numerous successful experiments in the direction of obtaining other colours in a natural manner conducted some years ago, it may well be asked if the present paucity is altogether creditable to the sericulturists of the period. In 1876 M. Roulin obtained pale blue cocoons by slightly dosing his silkworms with indigo, carefully mixed with their mulberry-leaf food, shortly before they began to spin. The leaves of the *Bignonia chica*, or trumpet-flower, of the river Orinoco—belonging to an order yielding the most gorgeous climbers yet met with in the world—enabled him to feed his worms so as to obtain beautiful red cocoons; and, doubtless, his investigations have since been rewarded by the production of further natural decided colours. About the same time another clever sericulturists, Ruimet des Tallis, discovered that a magnificent red tinge could be communicated to cocoons by feeding the silkworms for a time on a variety of vine, and a deep emerald hue by the use of lettuce leaves.

It is quite likely, of course, that the long-continued silkworm maladies of Europe may have interrupted those interesting and eminently important experiments, and the circumstance may be accepted as an excuse for tardiness in following them to a practical issue. But it is at the same time gratifying to learn that our countrymen who are about to introduce tea and silk-farming as a combined industry into New Zealand intend to prosecute this line of research with assiduity, as the splendid evergreen flora of those islands gives promise of unusual facilities for experiment, and points to the probability of a grand result.

TOBACCO.

THE total area under tobacco at the Ghazipore tobacco farm has, we observe from a report of the Agricultural Department in the N.-W. P. and Oudh, risen from 404 acres in 1880-81 to 482 acres in the year 1881-82, and the produce from 270,000lb to 326,000lb. The rate of produce per acre was for both years 675lb per acre. Of the entire produce of 326,000lb, 61,000lb were shipped to England, 60,000lb were manufactured into smoking tobacco for the Indian market, and 10,000lb were made up into cheroots, 2,800lb into cigarettes. The shipment to England realised 5*d.* per pound, and the prices realised in India were about 6 annas per pound for cavendish and one rupee for smoking mixture, 8 annas for cheroots, and 2 rupees for cigarettes. It is proposed, we see, to extend the area under cultivation, when a still better rate of produce is expected.

SEEDING TOBACCO BEDS.

MARCH and April are the months for making the tobacco bed or plant patch. At the South some of the planters make the bed in the fall, and we have known such cases here in the valley. Usually the bed is selected in the fall, fertilized or ploughed, or spaden in, then left until spring. When wanted for sowing, the bed is first spaded deep and all turf stone, bits of grass and rubbish of all kinds thrown away. In fact, the object is to make the bed as mellow as it can well be. The bed is now carefully raked, and made even, and rounding so that the water will run to either side. The bed may now be trod hard before sowing ; some omit this, until after the seed is sown.

In regard to the seed, whether wet or dry seed was sown ; if dry, it should have been put in pan half full of dry sand so that the seed will not come up in bunches, which makes the bed look bad. If wet seed is to be sown, take mould from about an old tree. This mould should be quite moist ; sift it, and mix thoroughly the seed and mould together. Put it under the stove, cover with a cloth so that it will not get too hot. If the seed is good, in 48 hours white specks will appear. That is the germ of the tobacco seedling. They should not grow too fast or too long, since they may be broken off in sowing.

The seed may now be sown by the handful (small) or by what one can hold between the fingers. As the mould is usually darker in color than the tobacco bed, one can tell whether he has sowed the bed even or not. Make, however, more than one bed ; sometimes it fails to come. They may be poor, or, for some cause or other, we have no plants.

We have been describing the process of making tobacco beds in Connecticut, and the method of making and sowing the seed is the same the world over. Most growers sow too much seed so that a good deal of pulling out is required. Havana and Yara plants do not require as much room in the bed as seedleaf plants, since they grow up like cabbage seedlings. In a few days the young plants will appear in the tobacco bed and in ten to twelve, if the bed is full of weeds, the work of getting them out will come in order. We prefer a damp to a dry piece of ground for this and many reasons. The seedlings, if kept moderately damp, are more apt to germinate than when sown on dry ground where they take up but little moisture, unless the watering-pot is kept a-going most of the time.

After the first weeding, which should be done well, sprinkle the bed with plaster, and let the bed go until 12 or 15 days more ; by this time the seedlings ought to be quite large, the largest leaves the size of a silver dollar. From this time forward until "settling," the beds are tended in various ways, the weeds pulled out, the small ones rejected, old trodden plants on the border thrown away, and, if necessary, the bed given a weak solution of Peruvian guano water. But don't give the seedlings too strong a dose, else they may be injured and destroyed outright.

In New England and the Middle States transplanting occurs from the 25th of May to 20th of June, but plants are "set out" as late as the 4th of July. Havana plants are bad to "set" since their roots are long like a cabbage. Of seed leaf from 5,000 to 6,000 plants are set to the acre ; of Havana, 6,000 to 7,000, according to the seed. We sow seed six or seven years in descent from the imported. A fine crop of Yara tobacco was sold here late at 16 cents. It produced about 700 pounds to the acre, at least the two acres brought $400, so the grower said. Grow good tobacco, and it is a profitable product. It is in demand now the world over.—B.—*Farmers' Review.*

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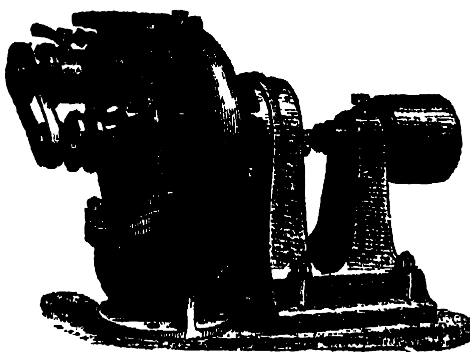
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The following are the principal advantages of the "Invincible" Pump :—

1st.—It is arranged to swivel on the bed plate, and may be placed at any angle simply by slackening a few nuts, without interfering in any way with the bed plate or the joints of either the suction or discharge pipes.

2nd.—It does not require a foot valve, being fitted with small air exhauster and clack on discharge which always keep the pump charged ready for work.

3rd.—The bearings are made on an entirely new principle, and one bearing will last out four of the old arrangements.

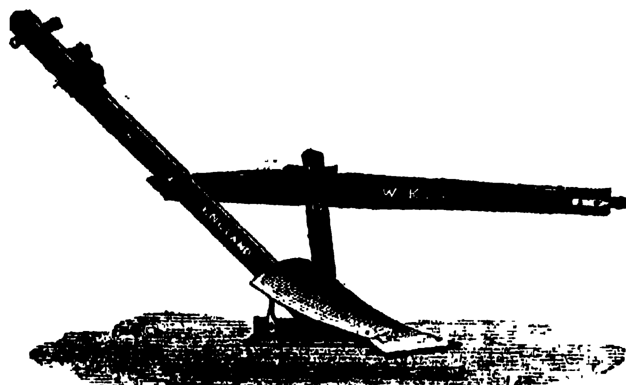


J. & H. GWYNNE'S "Invincible" Centrifugal Pump.

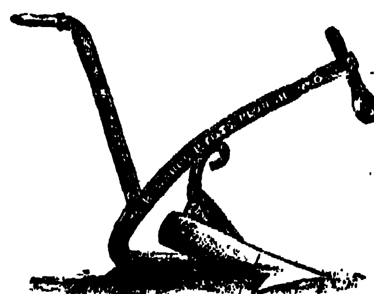
4th.—The form of the pump casing is so arranged that one side can be taken off in a few minutes for the inspection of the whole of the disc and interior of the pump.

5th.—Hand holes are made on each side of the suction pipes to enable any foreign matter which may get into the pump or disc to be easily removed. The covers are fitted with a bayonet joint so that they can be removed and replaced in less than a minute.

6th.—The "Invincible" is 25 per cent lighter than any other Centrifugal Pump in the market, and discharges at least 10 per cent. more water for the power applied.



Ransome's Indian Plough. Price, Rs. 15.



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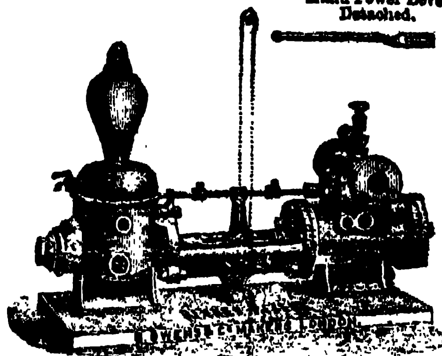
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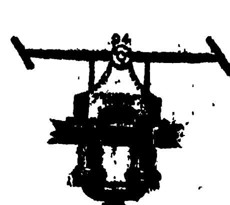
It is inte[illegible]le in all its working parts.
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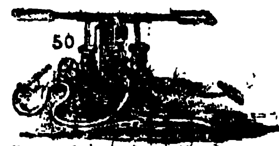

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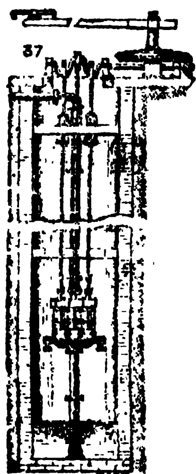
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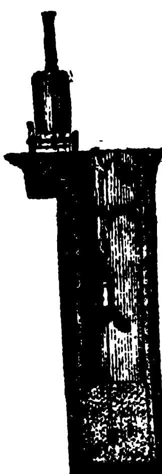
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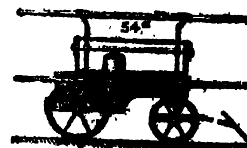
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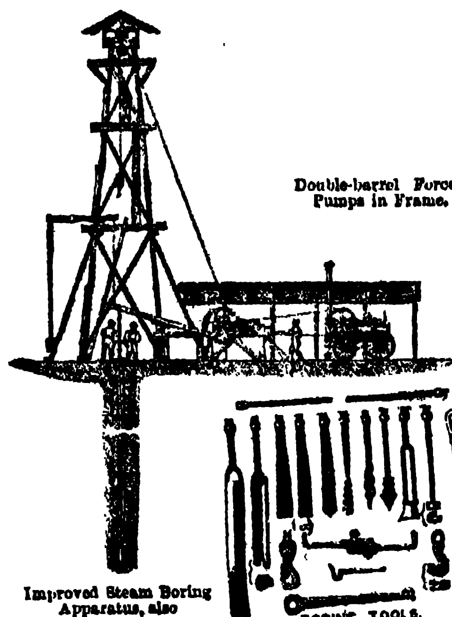
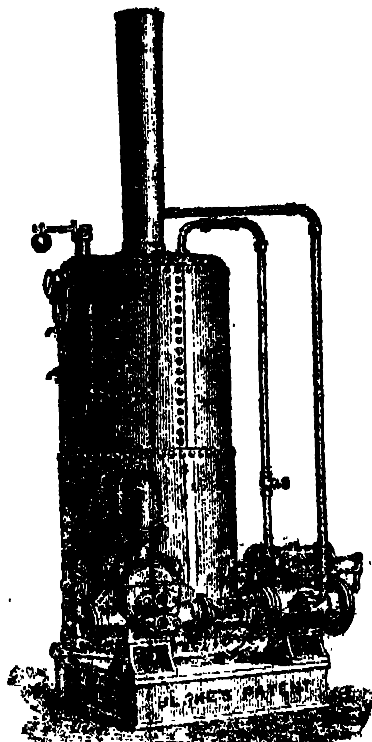

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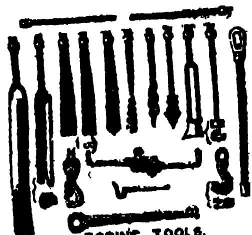


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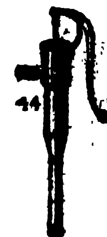


Force Pumps on Barrow.

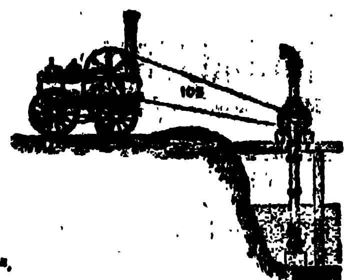


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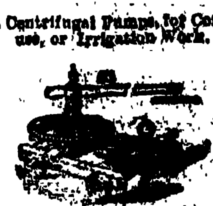
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A MONTHLY

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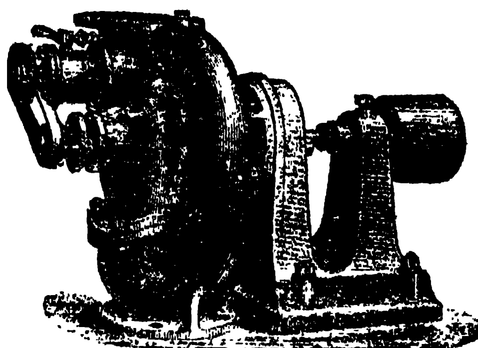
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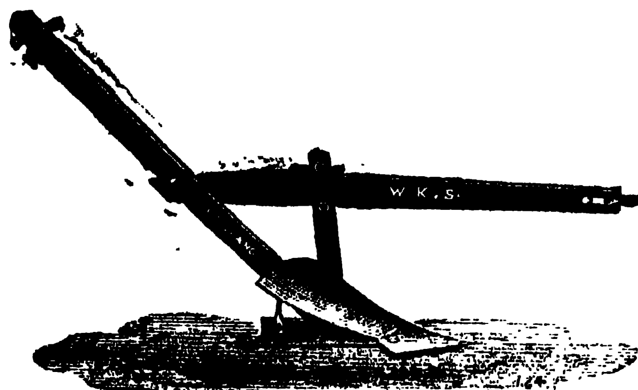


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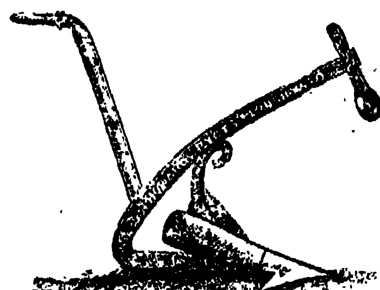
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All communications regarding literary matter should be addressed to the EDITOR *of the paper for which it is intended.*

WILLIAM RIACH.

June 13th, 1881.

CONTENTS:

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGEMENTS.

REPORT of the Joypore Exhibition, 1883.

CENSUS of the Central Provinces, Vols. I. and II.

FREE Trade and Protection, by O. E. Wesslau.

REPORT on the Cawnpore Experimental Farm for the *Kharif* season, 1882.

CORRESPONDENCE.

CARBOLIC ACID AND HEMILEIA.

TO THE EDITOR.

SIR,—In your issue of the 1st May you refer, in an article on *Hemileia*, the coffee-leaf disease, to the measures that have been recommended for the mitigation of the ravages of that pest, and you say "prominently the process of Storck appropriated by Schrottky."

Surely there is a misprint in this; the names ought to be reversed. For in January, 1881, I recommended, as the result of my experiments, the application of carbolic acid acting as vapour as one of the best means for checking the spread of the disease. The process was tried with some measure of success at several coffee estates in Ceylon during the same month, and public attention was drawn to them in the *Ceylon Observer* and *Ceylon Times*.

It was not for several months afterwards that we first heard of Mr. Storck working in the same direction in Fiji, and recommending a similar process.

EUGENE C. SCHROTTKY.

Mozufferpore, May 21, 1883.

NOTE.—In the year 1874 the fumes of carbolic acid were used in Ceylon on the estates of the Uva Coffee Co., Ld., and Springvalley Coffee Co., Ld. We are not alone in believing that Mr. Schrottky was, to put it mildly, considerably behind others in parading carbolic acid fumes. Mr. Storck, in the columns of the *Ceylon Observer*, claimed the process as his. We invite Mr. Schrottky to settle his little difference with Mr. Storck.—ED., *I. A.*

THE SUPPLY OF FOOD-STUFF FOR LIVE-STOCK, AND VEGETABLE FUEL, IN YEARS OF DROUGHT AND SCARCITY.

TO THE EDITOR,

SIR,—The causes of short or inadequate supply of food for the live-stock and fuel for burning are mainly the following :—(1) the distances of centres of consumption from localities where they are produced; (2) the unremunerative character of these supplies which prevent the populace from producing them; (3) the treacherous character of Indian rainfall; (4) the paucity of agri-horticultural produce of the country which prevents the live-stock from receiving their share of food; (5) the enormous consumption of wood for the railways; (6) the rapid increase of population which use wood fuel for cooking and sundry manufactures; (7) the want of adequate knowledge of growing such kinds of plants, agri-, horti, and arbori-cultural, which possess high value as fodder or

fuel, hence unsuited plants badly grown result in unremunerativeness which, after a single failure, are given up by the growers as no purchasers would care to purchase them.

1. In small rural villages, the number of live-stock, in ordinary years, is very small: the villagers always try to carry their surplus produce to such centres of consumption and trade where they may find ready sale of their produce at remunerative prices. The carriage adopted by them is their heads, and the backs of their plough or any other cattle, ponies and asses (rarely). Carts are used, but very limitedly, owing to the extreme badness of the internal district roads, which are entirely *kacha*, and rendered uncommunicable for heavy cart-loads by the travelling of foot passengers and that of animals of all kinds during summer and winter seasons; and during the rains these roads are the "slough of despond" to carts of any description, large or small, heavily loaded or otherwise; because the wheels stick fast into the mud and cannot be extricated unless the carts are unloaded and much labour and time wasted, for their stock in trade having much bulk and weight and little value. From what I have said it will appear that carriage of fodder and fuel from rural places is by very costly means to the distant centres of consumption; but the prices offered for these commodities are very small, which prevent the villagers from carrying these articles for sale. The subject to be here dealt with is whether sufficient fodder is produced for the cultivators' cattle, and whether any surplus is left for live-stock of other people who do not produce food but buy and feed.

An ordinary *ryot* of India, as a rule, cultivates 5 acres of *rubbee* (winter crop) and 5 acres of *khareef* (rainy-weather crop.) The minimum produce of these 10 acres, only one crop in a year to a given area, is as follows :—

	Grain.		Straw.	
	Mds.		Mds.	Mds.
Rubbee.—5 acres of wheat, barley, or any other cereal or pulse crop at 10 mds., of grain, and 20 maunds of straw, per acre	50	+	100	=150
Khareef.—5 acres of maize, millet or any other fodder yielding crop at 20 maunds of grain or seed, and 50 maunds of stalk, per acre	100	+	250	=350
Total produce	150	+	350	=500

For the cultivation of these 10 acres, in two seasons, the cultivator has two pairs of bullocks or 4 animals. These receive an allowance of 10 seers of chaff or stalk (*bhoosa* or *kutya*, H.) each daily during the summer and winter; in the rains they are allowed to graze and receive no stall feeding. So that the nine months' stall feeding represents a whole year's feeding for these 4 animals is $(10 \times 4) \times (30 \times 9) - 270$ maunds, which substracted from 350 (fodder produce) = 80 maunds surplus of straw reduced to chaff and dried stalk available for sale to non-producers of fodder who rear live-stock. The feeding allowance is the maximum because the ryot effects economy in feeding by mixing grass, oil-cake, &c., with the chaff or chopped stalk, thus enabling him to save and store fodder for some months longer for the ensuing year. My daily allowance to a milch cow of the *Jumnaparee* breed (large size) was only 5 seers of chaff and oil-cake, and cabbage and turnips. If the ryot be a good cultivator, he can certainly double or even quadruple his grain and fodder produce. The above estimate (a very close one) refers to the most ordinary unskilled ryot.

Here there are two causes,—distance and want of proper road communication which obstruct the free circulation of fodder and fuel—animals of one quarter starving and those of the other having more than wanted; so also there is plenty of fuel in one quarter and in another none at all, or a very inadequate supply.

2. Indian cultivators do not raise fodder and fuel plants separately. These substances are derived from produce obtained which were grown for other objects. For instance, the wheat plant is raised for its grain which serves as food for man, also for animals if given, and its straw serves as provender for the live-stock; the same might be said of trees which are grown for fruit, gum, bark, timber, and in rare cases flowers and leaves, and the branches serving as fuel. But nowhere will an Indian cultivator grow, as in the civilized countries, and as the primary object, any plant as food for live-stock or for fuel. The reason is no remunerative market will be found for fodder or for fuel if plants are exclusively raised for each of these two purposes. In the existing state of the Indian markets, therefore, if loss is suffered by the cultivators for these articles, they have other parts of the plants to fall back upon for profit. These facts and impressions are so strong in the minds of the cultivators that nothing short of well established profit will induce them to grow plants specially for fodder or for fuel.

3. The paucity, uncertainty, and in rare instances total cessation of rainfall are the main causes which have induced the Government of India to take in hand the very laudable object of supplying food for live-stock of all kinds and fuel for cooking food, the railways, and for manufactures.

4. The consumption of vegetable fuel by the railways is daily becoming so very extensive that unless immediate measures be adopted for keeping up the continuity of wood supply, it is not possible to meet the demand—the supply must fail. No statistics of the quantity of wood the State and other Railways consume in firing their engines, and in smelting, shaping, manufacturing, &c., in their workshops, per diem, have been gathered; and it is not known how much wood they annually burn. These require to be known to arrive at the data on which to base the estimate of area to be under fuel-supplying plants. It should be borne in mind that wood fuel demand by the railways, unless coal takes its place, will continue to increase as new railway lines go on opening and to be opened.

5. The demand for wood fuel for cooking food is daily increasing by the increase of human population of India. It is said the average of human population of India is 300,000,000 which number multiplied by 8, the average number of pounds of fuel burnt daily per head, gives the large quantity of 2,800,000,000 lb = 1,250,000 tons of wood burnt daily in India, and the last number × 365 (the number of days in the year) = 456,250,000 tons of fuel consumption for cooking food per annum. The above figures should be taken as approximate average of annual fuel consumption of India for cooking food only; and it includes fuel burnt on festive occasions and sweetmeat and other edible manufactures. It is not known what quantity of wood the mills and manufacturing engineering establishments, &c., use for their engines, smeltings, boilings, &c., no statistics having been gathered. Charcoal being the compound carbonaceous residuum of wood, obtained by artificial means, is included in wood.

The approximate estimate of wood consumption under this paragraph, plus that of para. 4, will give the total fuel requirements for the whole of India. In computing for the area to be under fuel-supplying plants, maximum should be taken.

The inference of the whole described above is that the landholders and the cultivators having failed to achieve the objects which lead to the prosperity of the country, the Government of India proceeds to supply fodder and fuel, apart of other wants, which is very good indeed. I should surmise the proviso equally require to be extended to all parts of India under the sway of the British Government of India, and not confined to small tracts of the country which have shown symptoms of collapse; because the paucity of fuel is very greatly felt in Oudh, Bengal, and other provinces where trees are fast disappearing to supply wood for burning.

It will not be out of place here to suggest that the reserves for fodder and fuel should be as close as possible to the centres of consumption, *viz.*, large villages, towns, and cities, and with due regard to good road communications, existing or to be constructed.

By *right of conquest* the British Government of India has full rights to appropriate any area, and of any situation of land without any payment. But the Government of India promises to pay *reasonable price* for the land it will appropriate, which shows how great a condescension and leniency it has towards its subjects.

O. L. BRYCE,
Agri. Analytical Chemist,
Late Supdt., Agri.-Hortl. Socy. of Oudh Gardens.
Bahraich, Oudh, April 26, 1883.

INDIGO PLANTING.

TO THE EDITOR.

SIR,—I have been some time in search of a work on indigo planting and manufacture, but have not been able to find one. Will any of your numerous subscribers be kind enough to give me the name of such a work, and from where it can be procured?

ENQUIRER.

The Indian Agriculturist.

CALCUTTA, JUNE 1, 1883.

PLANT DISEASES.

IN our last issue we endeavoured to show that the origin of disease in plants was due to an excess of hyper-organised matter, notably albuminoids, consequent on the reckless administration of certain fertilisers. The chemical composition of mildew fungus in a manner supports this assumption. Two specimens of mildew generated from solutions of sugar and gelatin, and sugar and ammonium chloride, analysed by N. Sieber, (J. pr. chem. (2) 23, 412-421) gave respectively the following results :—

	I	II
Substance soluble in ether	18·70	11·19
" " " alcohol ...	6·87	3·36
Ash	4·89	0·73
Albumen	29·88	28·95
Cellulose	39·66	55·77
Total	100·00	100·00

The substance soluble in alcohol and ether was crystalline, but its composition was not determined. We have however in the one mixture, or *soil*, producing the mildew, gelatin, and in the other ammonium chloride, substances both of which will yield nitrogen on decomposition. From the plant albuminoids therefore it may with strong reason be inferred that mildew, such as the *hemileia* springs. There can be but little doubt that this pest, and others, such as the *Tylenchus Havenstirnii* found by Kühn in lucerne and red clover, the *cephus pygmæus*, and *C. troglodytes* found by Brummer in rye straw, and which is the cause of its blanching ; the contagious fungi, *telletia, caries* (stinking smut), and *t. calvis* of wheat, the *telletia maydis* of maize, the *plasmodiphora brassicæ* of cabbage, the *agaricus melleus* of the mulberry, and the *phytoptera infestans* and *saprophyte* of the potato, are of like composition and like origin. The phytoptera and saprophyte are presumably the direct effects of fermentation, for Reinke and Berthold have found in phytoptera infested potatoes, bacteria, *bacillus subtilus*, and *bacterium nevicula*. Potatoes having a maximum of starch resist the disease most energetically, while those grown on moist soil containing much organic matter, such as stable manure, are most liable to attack. The reduction of the amount of sugar in the roots of the vine when attacked by phylloxera points also to a like internal disturbance as being the cause of mildew appearing on the roots. In the case of the vine, however, the fermentation may be induced by some diastatic body, or it may be the result of hydratation. The sugar (saccharose) appearing in the stalks of some plants is considered to be a direct product of the elaboration of chlorophyll. Glucose is in most cases not found unaccompanied by saccherose ; it is therefore a product of the hydratation of the latter. When therefore there is an excess of chlorophyll-forming substance in the soil, *i. e.*, organic nitrogenous matters, saccherose may be changed to glucose, which, under certain conditions, will ferment and yield fungi, harmless perhaps at first, but which might blend with other germs, and after several transitions give rise to fungi of a virulent type.

Diastatic fermentation in plants may with propriety be ascribed to an excess of albuminoids, and the fact that diseased vine leaves contain more nitrogen than the healthy leaves renders it probable that phylloxera may have originally been the result of diastatic disturbance : at any rate, the fungoid diseases of the vine may with strong reason be ascribed to this cause. The fact that the seeds of the vine, which resist the attacks of phylloxera, are stronger and more regularly formed, points either to a draining of the sap by this pest, or to a fermentative disturbance following exhaustion. The vine, like coffee, is a huge feeder on potash, but it is questionable whether it gets this either in the shape or quantity required. In this connection it has been proved that clover sickness and the disease of the horse chesnut are due to the want of this element in the soil, and that they are remedied by its introduction—thus incontestably proving that clover sickness cannot be due to the parasites proper found thereon. We therefore with reason argue that phylloxera is due to a like want. Lime, it is understood, is as necessary to young plants as it is to young children, but we do not recognise this necessity—that is, generally speaking, for had we half attended to the wants of plants in this respect, many a plague familiar to us to-day would have been unheard of. A judicious use of it now will, we venture to predict, greatly modify existing plagues, and avert others.

In all solutions containing bacteria, says Wernich, "a time arrives when they cease to propagate, and after a longer time, they lose their power to induce further life in fresh nutritive solutions." From this fact it is argued that the putrefaction induced by bacteria produces substances which are poisonous to these organisms. Some such reaction may take place when hemileia is at a low ebb, and its reappearance may be due to the development of *new bacteria*. If this be so, it remains for us only to withdraw and withhold from the soil material conducive to fresh development, if we wish to render extinction permanent. Bacteria have been found in air drawn from the soil ; whether, however, they find their way into plants and communicate disease direct is doubtful. It is more reasonable, knowing that putrefaction may be either a diastatic or a purely hydratic change, to suppose that they result in the usual way from the putrefaction of albuminoids, and that by the succeeding fermentation peculiar to their presence, substances are developed which are deadly to themselves. Indeed, experiment proves that substances most disposed to putrefaction may be preserved from it by means of phenol, skatole, and indole—*products of putrefaction.* "These experiments," says a commentator on Wernich's views, "lead to the solution of a highly interesting problem in pathology." And the author himself says that the same or similar operations are carried out in the progress of septic diseases, and that the supposition that the organisms which are the cause of infectious diseases, give rise to products which eventually cause their own extinction, is the only way in which the progress of these diseases can be properly comprehended. Here the idea of inoculation occurs, which, with respect to coffee plants, has already been worked on, but not completely. If we admit, however, that in the reactions attending the appearance of hemileia, and other fungoid growths, their own distinctive antidotes are produced, we would still have to withhold from the soil the essentials to fresh growth before any such disease could "burn itself out." We therefore repeat, and we cannot be too clear on this point, that the use of these antidotes externally, or even by innoculation, will avail us nothing while the conditions necessary to fresh growth remain. Given, we say, the conditions necessary to fermentation proper, hydratation, or putrefaction in the plant, and we have not far to seek for the origin of diseases. We have in hyper-organised sap a ready nidus for disease spores from without, and all the conditions for their actual evolution within. Agriculturists up to the present time have taken a certain interest in chemistry, the atmosphere, and the weather, in the food of plants and their value ; they have noticed the occurrence of disease, and the peculiarities of its recurrence; they have been always ready to try any nostrum forced upon their attention ; and still foster the vain delusion that these plagues will be removed by God, or that some genius will discover the remedies approved by grace. The custom of attributing these visitations to God is weak and puerile in the extreme. The fault is with ourselves. We neglect to study the physiology of the plants we cultivate, and when by haphazard means we fail to remove the evils attending this neglect, we come to the conclusion that the Great Geometrician of the Universe has suspended locally, or checked, what we may appropriately term the great fundamental law of nature—vegetable growth. If we admit this assumption, surely coffee-planters and growers of the vine are a peculiarly wicked people. The mere fact that these diseases vary in intensity with the alternation of the

seasons; that, like the plants which constitute the soil in which they flourish, they are subjected to precisely similar laws, with regard to climate and temperature—is indicative of their origin, and not only points to the truth of Wernich's remarks about each producing its own antidote, but to the means for making the effects of such permanent; and that they are no more indications of Divine anger than are common weeds. It is true that we do not as yet know the precise causes of the bulk of the diseases casually alluded to, but knowing the causes which have conjointly conduced to their development, it is in our power to extirpate them. That this end may be easily attained we incline to believe, even in the absence of unanimity, but in cases of this kind, unless unanimity is guaranteed, *individuals* will not work; they will naturally argue that, when they have banished the disease from their own possessions, it may again be communicated from without. We are firmly convinced that were the essentials to hyper-organisation withdrawn and withheld from an area of soil, no such recurrence would result; but we are unable to say whether and how far we are right, so long as we are deficient in a clear and definite understanding of the penetrating power of atmospheric disease germs on healthy plants. We are certain, however, that such could not originate within healthy plants. We would, therefore, for ourselves adopt measures for the restoration of a healthy state of things, without fear of suffering from the apathy of our contemporaries. We can well imagine that we would be alone in this respect, or nearly so, but one such example would be sufficient to show the wisdom or folly of our argument. The whole question seems to us very simple. These diseases grow, ripen and cease. They grow again and ripen and cease: consequently it seems logical to aim at stopping their growth, and folly to simply kill them before their time. In the one case we attack the cause, and in the other the effect. We are far from saying that it is hyper-organisation of the sap is due directly to neglect, for we know that certain esculents suffer from a sudden fall of temperature, and we have seen coffee at high altitudes suffer from the same cause: the epidermis cells become ruptured, and the circulation of the sap is impeded, and this effect alone could, we know, result in fungoid disease, and be followed by parasitic attacks. This susceptibility, however, of the plant to suffer from cold is in most cases we think, due to some defect in the soil: to the want of some essential in the plant; therefore, consider them as we may, we are instinctively led back to the belief that hyper-organisation, if not the direct cause, is the primary effect of that cause, and the effect from which all bad results spring.

THE CAWNPORE EXPERIMENTAL FARM REPORT FOR THE *KHARIF* SEASON, 1882.

NITROGEN, it seems, is still the element to conjure with and swear by at Cawnpore. Mr. Fuller has been translated to the happy hunting-grounds of the Central Provinces, and Major Pilcher planted in his stead in the nitrogenous deficient soil of the Cawnpore Experimental Farm. Major Pilcher, the soldier, has beaten his sword into a lot of ploughshares, and his other implements of war are exchanged for crucibles, retorts, re-agents, soluble phosphates, bone dust, and other interesting substances. We have no knowledge whatever of Major Pilcher. He may be the most suitable man in all India for the position he has been placed in at Cawnpore; but this square-man-round-hole business of placing soldiers and warrior judge, in charge of Experimental Farms seems to us about as wise as placing ploughmen and pig-drivers in command of regiments, and giving district and divisional commands to growers of big cabbages, superlative turnips, and gigantic gooseberries. The Cawnpore Farm may want nitrogen, but it has now got a Major. May we hope that the presence of the one will counterbalance the absence of the other? Major Pilcher, however, is probably better known, at all events in Lucknow, as a Small Cause Court Judge, than as either soldier or an agriculturist. On the authority of Mr. Bennett, the Director of Agriculture of the North-West Provinces, Major Pilcher has also a practical knowledge of chemistry. On the whole, what more does Cawnpore want? Let it solace itself for its want of nitrogen. It seems to us that Major Pilcher, with all his varied experiences and acquirements, speaks with a lesser power of assertion in his report than the Director of Agriculture does in the resolution on the report. "As far as they go," says Mr. Bennett," the trials of various kinds of manure confirm the main results of previous years, and point to nitrogen as the element in which the soil of the farm is deficient. On four standard plots the average produce given by nitrogenous manures was 2,138lbs. per acre, while that given by phosphates and manures not rich in nitrogen only averaged 1,337lbs. On the duplicate plots the averages were 1,695lbs. and 1,014lbs., respectively. The increase in outturn was 60 per cent in the first case, and nearly 70 per cent in the second."

Major Pilcher, on the other hand, while recording the superiority of yield from nitrogenous manures, says, with becoming caution, that little is to be learned from experiments which have little continuity.

"Nitrogenous manures," we are quoting Major Pilcher, "as may be seen, maintain a very marked superiority in yield as against manures yielding little nitrogen; and the duplicate plots corroborated fairly the results of the standard plots save in the case of the saltpetre standard plot, which shows a variation due probably to unexhausted poudrette. There is little to be learnt, however, from experiments which have as yet so little continuity; and patience must be exercised until a sufficient number of annual experiments have been carried out to enable us to assert positively that, by a certain expenditure on any particular manure, corresponding increase in produce can be obtained, returning a fair profit on such expenditure."

The truth appears to us to be that in India, where officials are changed about from "pillar to post," continuity in agricultural experiments seems impossible; and even were continuity of experiments insisted on by the Government of each province, and officials of the Agricultural Department appointed to work out certain experiments under the natural variations common enough year by year in rainfall, sunshine, heat, wind, and all else that make up climate, the initial difficulty in our estimation would be to get men capable of conducting such experiments, and deducing general results from them. The power of observation and experiments is not by any means so common as most people believe; in fact, so uncommon is it that when a man really capable of accurate observation and exhaustive experiment does appear, he takes the very highest rank in those subjects he has devoted himself to. Of all the fields of knowledge in which men have sought to bind the forces of nature to the chariot wheels of science, probably none are so difficult and intricate, with constantly changing conditions and unexpected results, that baffle all chance of eliminating as the experimental study of agriculture. It requires no Indian Experimental Farms to prove that the application of certain manures under certain conditions results in a heavier and better paid crop. It is possible to produce the most astonishing results if crops are treated in small patches, horticultural rather than agricultural, and it seems to us that there has been a tendency in certain quarters to give agricultural experiments a horticultural twist. At all events, experiments are conducted at Experimental Farms under conditions that place the reproduction of them by the ordinary ryot entirely out of the range of possibility. The changing of officers breaks the continuity of experiment, even supposing they were capable of conducting experiments that would result in something more than mere commonplace, or the reproduction of the ill-digested opinions and assertions of pretentious men.

Perhaps the most interesting part of the report is that devoted to the attempt to manufacture sugar from the sorghum plant. The advantages which sorghum possesses are, "that it can apparently be grown as an ordinary *kharif* crop on poor land, year after year, without irrigation, and does not require the great labour, expense, and capital requisite for sugarcane. It only occupies the ground four months, and can be grown in places where sugarcane cannot be grown at all. If too poor a crop for sugar, it is still a most nutritious fodder for cattle, the seed being also good food. If fine enough for sugar, it keeps the mills going for a month earlier. Cattle eat the *megass* greedily, while they will not eat that of sugarcane. The leaves

and tops also go to the cattle. From fermented juice alcohol can be distilled, and from the skimmings of the boiling-pan, vinegar can be manufactured. Sorghum may therefore be said to have potentialities.

The following is what is said regarding sorghum sugar in the report under notice :—" The attempts of last year to manufacture sugar from sorghum were renewed this year and with better success. Two fields were sown.

(1) " Was divided into three sections, which were respectively planted with Minnesota early amber, acclimatised red sorghum, and acclimatised black sorghum. The field was manured with farmyard manure at 100 maunds to the acre.

(2) "An unmanured plot in which sorghum was planted for cattle-food.

" Contrary to expectation, the unmanured plot gave a better crop than the manured plot. This may have arisen from the fact that No. (1) lies lower than No. (2), and was waterlogged for some time in July. In America the general opinion is in favour of a sandy upland soil well drained, but not freshly manured. A professional sugar-boiler (kindly procured for the farm by Messrs Thomson and Mylne) could make nothing out of the juice at first, and pronounced it impracticable. One of the farm apprentices, accustomed to sugar-boiling, then tried his hand on it, and by the use of lime succeeded at last in making *goor* of fairly good quality from the early amber and the red varieties, but for a long time failed with the black variety : eventually succeeding with that also by adding a very small quantity of carbonate of soda, as well as lime, to the boiling juice.

" Samples were sent to Carew and Co., Limited, to Messrs. Thomson and Mylne, and to the Agri-Horticultural Society, Bengal. A sample was also submitted through a native gentleman to a committee of sugar-brokers in Lucknow, the manner and place of its production being carefully concealed. The following opinions were received :—

MESSRS. CAREW AND CO.

" ' I have now the pleasure to send analysis of your sample of sorghum, and to remark—

" ' 1st.—It is very acid. Having no experience of sorghum juice, I do not know how far this is due to delay or accident in manufacture.

" ' 2nd.—The amount of glucose is large and is probably due to the acid, which has the effect of converting crystallizable sugar into glucose, if present in a heated solution.

" ' 3rd.—Each part of glucose present is held in refining to convert another part of crystallizable sugar, and this with the allowance for ash reduces the available sugar from your sample to 24 per cent.

" ' As a rule, we would decline sugar with so small a result.

" ' My valuation is of course for refining purposes.

" ' It is pronounced here less sweet to the taste than cane *goor* ; but it seems to me that, in small quantities, reaching the market early, it should bring top prices, *viz.*, Rs. 3-8 to Rs. 4 per maund.

Sugar analysis.

Sample received—November 13th.
Marked Amber Sorgho *Goor*, 2oz.
Description—*Goor.*
Colour, &c.—light yellow—*Very acid.*

Composition.

Cane sugar	61·00
Glucose	23·85
Ash	3·15
Insl. matter	0·23
Colouring matter extractive ...	3·78
Water	7·99
Total	100·00

" ' Available sugar 24·5 per cent.' "

MESSRS. THOMSON AND MYLNE.

" ' The sample of *goor* you sent us is of the kind made for eating, and is not used for making sugar ; the present highest rates for eatable *goor* and *goor* for making sugar are 13½ and 15 seers per rupee respectively, and the value put upon your sample is 12½ to 12¾ seers per rupee.' "

It may interest our readers to know that the Americans have succeeded in producing samples of the very finest sugar from sorghum ; 24lbs. of dry pure crystallised glucose, closely resembling loaf-sugar, has been obtained from a bushel of corn which can be sold at 2 to 2½ cents. In attempting to introduce this plant, the Cawnpore Experimental Farm has done good work, and it is much more pleasant and a good deal more profitable to read in Cawnpore Farm Reports of the sorghum plant and its " potentialities " than of the second-hand crudities of Lille about nitrogen.

ECONOMIC MUSEUMS.

THE Bengal Economic Museum is closed, and its collections are about to be removed to the Imperial Museum. For all practical purposes, it might almost as well never have existed, and we imagine that very few people in want of particular information about some industrial product of the country ever went to it to obtain what they wanted. This was not for want of specimens. Of some products, there was a bewildering superabundance of specimens. It seemed as if every specimen that came in had to be bottled and labelled, and every new bottle was supposed to add a new variety. This was not the fault of the gentlemen in charge—but it is useless now to enquire whose fault it was. Let us rather follow the old collections to their destination, and enquire whether there is a future life for the defunct Economic Museum.

It seems that there is at least a hopeful prospect before it. We gather from a resolution of the Government of India, which, though not yet published, has chanced to come under our notice, that larger and more liberal thoughts on the subject of the museum are at present struggling to the birth, and are really likely to shape themselves into a grand practical result. Though the resolution referred to is at present but slowly working its way through the hands of the provincial governments and administrations, we believe that the general idea of it has already met with a large amount of official approval. On the scope and probable utility of the idea, we may have more to say afterwards. But some general features of the proposed scheme and some considerations more or less closely connected with it, and with the forthcoming International Exhibition, may at the present time be profitably referred to. The new scheme may be briefly described as one for the consolidation and centralisation of all museums of whatever description and wherever located into a complete and uniform system, or into what, from the official point of view, might be called a single Imperial Department. The central administration of the museums would naturally devolve upon the Revenue and Agricultural Department. The living idea pervading the scheme is to make known and utilise to the utmost the industrial resources of India. The means employed will be to collect, to compare, to exhibit, to make everywhere easily accessible to every enquirer, the best procurable specimens of whatever nature man have been able to produce in this peninsula. The result, it is to be hoped, would be the revival of decayed or decaying industries, the stimulation and improvement of those now existing, and probably the creation of new ones. To come down from generalities, however, it is hoped to attain these great results through the agency of a system of museums, under trustees and local committees, but also under the central control of the Revenue and Agricultural Department. In each presidency or province, there would be a central museum, and in Calcutta the great Imperial Museum. In each division, or at any rate wherever a large city or town exists, there would be a divisional museum, and every important district throughout India would have its local museums. Thus in Bengal, there would be the central or Imperial Museum, and probably divisional museums at Patna, Dacca, and Cuttack, while such places as Monghyr, Krishnaghur, Berhampore, and many others would have local museums. Wherever any important industry was associated with a certain population, there would be a local museum, and the smaller museums would of course act naturally as tributaries or

feeders of the larger. The collections kept in the local museum would be confined to articles procurable in the district itself, together with samples of a better kind, if such were obtainable, from other parts, so that local art and industry might be taught in what it was defective, and stimulated to competition and improvement. It would also be important to keep all specimens in duplicate, so that the demands of Foreign and International Exhibitions might be met without any special labour on the part of district officials.

A very good example of a district museum may be cited in the neat and beautiful Monghyr museum, next door to the zilla school. This unique collection was made by Mr. Lockwood, a former magistrate and collector, now retired from the service, and is a standing memorial of the intelligent interest he took in his district, and the thoroughness with which he studied its characteristics and resources. By a glance at the coloured map, a visitor to this museum can see at once where and to what extent each product of this district is to be met with. If such museums could be established at all important centres, and attached in some way to our high schools or zilla schools, they would supply a great want in our system of education. They would afford the means of imparting scientific and industrial knowledge, and might be also so used as to stimulate among the boys a love of natural history, and give a useful turn to the boy's natural desire of making collections. Our system of education has been sadly deficient in any effort to shake off the apathy of Indian youths, and to train their powers of observation and their interest in natural objects. It does not appear in the Resolution whether this idea of associating the district museums with the high or zilla schools has been suggested to the authorities, and we therefore commend it to their consideration. While the museums might be made of the greatest use in the training of the young, the activities of the youth might be employed in enriching the collections. They must, of course, be under the superintendence of district committees, and the district officer would be *ex-officio* chairman of committee. Specimens of all the products of the district would be forwarded in duplicate or triplicate to the divisional museum, and by it to the central museum of the province, and thence to the Imperial Museum of Calcutta. Each specimen would bear a certain registered number permanently affixed, which would be the same in all museums where the article was exhibited. Thus the Imperial Museum would have specimens of all the important products of the empire, and each provincial, divisional, and district museum would have the specimens of its own province, division, or district. It is also in contemplation that duplicate specimens should be sent to the chief European museums, each bearing the registered number which it bears in the place of its nativity.

It will be seen that the idea is a large one, and yet, if systematically carried out under zealous supervision, it does not appear that there should be any insuperable difficulty in the way of its realisation. It would be a work of some time, but if once the main lines of the scheme were practically laid down, steady and gradual progress towards completion might be secured by intelligent superintendence.

THE TRADE OF ASSAM.

WE learn that the total river-borne trade of Assam, for the year 1881-82, reached a value of Rs. 1,95,61,593 for imports, and Rs. 3,62,86,691 for exports. The trade of the Brahmaputra Valley with Bengal and the trade of the Surma Valley contributed to these results in the following proportions :—

	Imports. Rs.	Exports. Rs.
Brahmaputra Valley	97,43,704	2,26,21,136
Surma Valley	98,17,889	1,36,65,555

Compared with the results of the year 1880-81, the trade of the Brahmaputra Valley with Bengal shows an increase in value of Rs. 17,88,002 under imports, and a decrease of Rs. 3,57,540 under exports. The increase in imports occurs chiefly under piece-goods (European), gram and pulse, rice and liquors. A more extensive demand is gradually springing up for piece-goods of European manufacture, and the trade, it appears, is being pushed further and further into the interior by the Marwari merchants. The large import of twist and yarn proves that the native weaving industry still survives in many places. Most of the liquor imported is consumed on the tea gardens, and during the year under report there was an increase of little over half-a-lakh. The decrease under exports appears only under tea and oil-seeds. Compared with 1880-81 there has been a falling off in value of Rs. 8,91,300 in the exports of tea. We observe, however, that the local Administration is inclined to doubt the accuracy of these figures. The tea report for 1881 showed a crop of 23,725,026lb, or taking the maund at 82lb 2oz., 2,88,889 maunds. In the previous year 1880, the report showed only 21,493,639lb, or 2,61,718 maunds, while the export returns showed 3,03,609. It is believed that the crop for 1881-82 was greater than that of the previous year, not only from special tea returns, but also from figures furnished by tea-brokers, which give an outturn of 24,390,732lb in 1881, against one of 24,021,375lb for 1880. As regards the other articles of export, we see that there is a considerable increase during the year under report under rubber, and that the jute export has nearly doubled, while the export of lac has more than doubled. A satisfactory increase also occurs in the exports of silk.

The trade of the Surma Valley shows an increase in value under imports and exports of Rs. 9,08,215 and Rs. 7,91,246 respectively. The increase occurs chiefly under cotton piece-goods, the value of which carried up-stream has risen by 9 per cent ; tobacco which shows an advance of 56 per cent over the imports of 1880-81 ; salt, the increase in which exceeds 23 per cent ; and oils, under which there is an increase of 113 per cent, and is ascribed to the more extended use of kerosine oil. The export trade shows an increase under tea of 16,050 maunds, or 9·5 per cent, and under paddy the exports amounted to 10½ lakhs of maunds against 1,63,260 maunds. There is also an increase of 5,47,690 maunds in the exports of lime during the year. The monopoly which formerly existed in this important business, has now been broken up by the local Administration, and the policy is stated to be at length bearing fruit in increased production and wider markets. It appears that limestone was never before so cheap as now at the marts on the Surma river, where it is delivered from the quarries on the Khasi hills. In June last limestone is said to have been sold at Rs. 135 per 1,000 maunds.

Some interesting information is given in the report regarding the coal-fields of Upper Assam, and we learn that those situated on the northern face of the Naga hills from the Dehing east of Makum, westwards to Dessai, are to become available as a store of force in the development and industrial progress of the province. In the Makum hills we see it stated that the coal-measures, in thickness and quality of coal, are among the first in the world, and are practically inexhaustible. It is also stated that the coal in the neighbourhood of the Dikhu river in Sibsaugor, west of the Dehing fields, may soon be brought under profitable working. The report goes on to say that "on the side of Sylhet and Cachar there are, it is true, coal deposits in the Khasi and Jaintia, and possibly in the North Cachar hills, while a fine field exists in the heart of the Garo hills on the Someswari river, up which one of the projected lines of rail would be carried, but so much as is known of the Khasi hills coal, which is for the most part situated in places difficult of access, and occurs in 'pockets' or hollows, with seams which rapidly die out, each pocket covering but small area, does not make it probable that coal from this source could compete with the massive, easily-worked, and almost inexhaustible coal-measures of Makum, and as Raneegunge coal can under-sell that from Cherra at Sylhet itself, there seems no reason why Makum coal, if conveyed across the hills, should not under-sell at the same place coal from Raneegunge."

FOREST ADMINISTRATION IN HYDERABAD.

THE report of forest administration in the Hyderabad Assigned Districts for the year 1881-82 shows that good progress was made during the period in re-classifying the district forests. The forest area of the province stood

at 4,424 square miles on the 31st March 1882, or an increase of 168 square miles over the total area of the preceding year. The changes which occurred during the year under notice are exhibited as follows :—

Description.	Area in Square Miles.			
	On 1st April 1881.	Added during year.	Excluded during year.	On 31st March 1882.
State Reserves	960	126	....	1,086
District Reserves	420	8	126	308
District Unreserves	2,870	260	100	3,030
Total	4,256	394	226	4,424

The transfer of 126 square miles from the district reserves to the State reserves, and the addition of 260 square miles to the district unreserves, were the chief modifications during the year. We observe that the demarcation of the State reserves is stated to be almost complete now.

There were 369 prosecutions for breaches of forest rules during the year, of which 309 resulted in convictions. It is said that new rules have been drawn up for the province, and that the Forest Act of 1878 will no longer apply to the Berars when they have been once introduced. Compared with the preceding-year, the results of fire protection during 1881-82 have not been so successful. The area attempted to be protected was 599,304 acres, while the area actually protected was 552,931, resulting therefore in a failure of 46,373 acres. We see it stated, however, that the injury caused by fires was not very great. In four cases, they were caused by lightning, while in nine, they were the work of incendiaries. The Conservator of Forests brings to notice, as one of the effects of fire conservancy, the enormous increase in insects—an evil which, it is said, is beginning to be felt more and more every year. Among the insects, he mentions a caterpillar, which, in the first break of the rains, especially if it is a long one, attacks the teak tree in swarms, leaving it almost bare of foliage, and thus checking its growth to a serious extent. Teak seedlings, too, it is remarked, suffer great injury from an insect which buries its eggs in the latest growth. On the production of the larvæ, large excrescences are raised, and the leading shoots ultimately killed.

The financial results of the year have not, it appears, been very favourable, and the State and district reserves both show a decrease in the revenue. The receipts of the year have amounted to Rs. 2,33,815, or a falling off of Rs. 32,741 compared with the revenue of the preceding year, while the expenditure, which has been Rs. 1,51,693, shows an increase of Rs. 22,724 over the charges of 1881-82. The decrease in revenue of the year is due to a falling off of Rs. 8,103 in the sale of timber of Rs. 4,280 in the sale of bamboos, and of Rs. 22,437 in the sale of grass and grazing fees.

COTTON IN BOMBAY.

MR. PRITCHARD'S report on cotton for the Bombay presidency, for the official year 1881-82, has earned the thanks of the Local Government for the interesting and valuable information which is supplied in it. The cultivation of cotton is extending very satisfactorily in that presidency, as will be seen from the following figures. The area sown with cotton during the year is shown as 4,811,146 acres as against 4,193,154 acres in 1880-81, while the estimated outturn has risen from 1,929,772 cwts. in 1880-81 to 2,578,555 cwts. in 1881-12. Although these figures may be capable of improvement, the Local Government thinks that they may be safely taken to prove that cotton cultivation is making great progress. The increase in the area sown is most apparent in the central division and particularly in Khandesh, where more than one-third of the whole cotton produce of the presidency (exclusive of native states) was grown. Here we observe that a much larger area was devoted to cotton than in the previous year, because the prices of food-grains had fallen low. Dharwar, Khaladgi, Hyderabad, and Kattiawar all show good increases in the area sown during the year. The average yield per acre of land sown with cotton, compared with the results of the previous year are given as follows, for the several divisions of the presidency :—

	1880-81. lbs.	1881-82. lbs.
Northern Division ...	61	72
Central „ ...	20	53
Southern „ ...	29	38
Sind ...	205	155
Native States, Northern Group ...	70	72
„ Southern Group ...	53	30
Total ...	52	60

The total estimated value of the cotton crop raised in the Bombay presidency during the year under review is shown as Rs. 5,49,18,356, against 4 crores, the value of the preceding year's crop. The average retail prices of cotton ruling in the different districts during the year varied from Rs. 11-4 per maund (Indian) in Surat to Rs. 23 per maund in Broach, while the wholesale prices ranged from Rs. 9 per maund in Surat to Rs 19-3-7 per maund in Poona. We observe it stated that 90 per cent of the total production of cotton was indigenous cotton and the remaining 10 per cent exotic. The latter variety is chiefly grown in the Khandesh and Dharwar districts, where there has been an increase over the preceding year both in the acreage sown with exotic cotton and in the aggregate outturn. The production of the year of this variety amounted to 282,266 cwts., or an increase of 164,298 cwts. over the outturn of the previous year. Although a good deal is being done to induce cultivators to give up the cultivation of the inferior indigenous variety of cotton in Khandesh and to take to the exotic variety, we see it remarked that as the Deshi variety—one of the inferior indigenous kinds—requires less rain than the exotic, people are induced in seasons of insufficient rain to favour the cultivation of the former in preference to that of the latter. The produce per acre of exotic cotton in the districts in which it is grown varied from 19 lb to 104 lb.

The cotton trade is reported to have been unusually brisk during the year. The total quantity of cotton imported into Bombay by sea and rail was 6,325,648 cwts. as against 4,279,535 cwts. in the previous year ; while the exports from Bombay and the ports of Kurrachee and Karwar were 5,462,854 cwts., or an increase of 2,319,929 cwts. over the exports of 1880-81. Of the imports by sea into Bombay, which amounted to 1,962,204 cwts., we find that 43,764 cwts. came from Persia, 30,880 cwts. from Madras, 63,619 cwts. from Sind, 710,876 cwts. from British ports in Konkan and Guzerat, 152,234 cwts. from Cutch, 929,937 cwts. from Kattiawar, and 23,085 from foreign Konkan ; while quantities, varying from 3 to 1,600 cwts., were also imported from certain native states, and from Bengal, Burmah, Goa, Diu, Muscat, Suez, Hong-Kong, Genoa, and Venice. Of the imports by rail—4,364,444 cwts., the Bombay, Baroda and Central India Railway brought into Bombay 1,266,920 cwts., and the Great Indian Peninsula Railway 3,096,524 cwts.

The export trade with the United Kingdom, Belgium, Greece, Austria, Russia, Italy, and China shows a great improvement over that of the previous year, while the exports to Germany, France, Holland, and Spain have fallen off somewhat. The countries which took the largest quantities during the year were—

	1880-81. Cwts.	1881-82. Cwts.
United Kingdom ...	1,032,098	2,902,166
Belgium ...	62,975	224,685
Greece ...	1,750	7,210
Austria ...	507,694	600,638
Russia ...	13,750	16,115
Italy ...	558,743	780,868
China ...	130,932	186,983

In regard to the trade with the United Kingdom during the year, it is remarked that the exports were the largest recorded for many years past, being very little less than the aggregate of the exports to the same country in the past three years. The increase, it is said, is partly due to the disturbed state of Egypt, which caused a heavy falling off in the exports from that country to the United Kingdom, and partly to the abundance of the Indian crop and the consequent fall in the market rates. The report

says "that the aggregate value of Indian cotton imported into the United Kingdom during 1882 was 86 per cent higher than the value of the average annual imports of similar cotton during the last five years; and represents 24 per cent of the total value of all cotton imports during the same period." The report goes on to say that "the prices for cotton ruling in the Liverpool market in 1881-82 were slightly better for the Hinghunghat, Dharwar, and Kumta varieties than in the preceding year, and compared favourably with the prices ruling for the same varieties in the Bombay market, which were somewhat lower than the average of the preceding year. Broach and Dhollera cotton commanded the same average prices in Liverpool in 1881-82 as in the previous year, though these varieties were quoted at a somewhat lower figure in the Bombay market than in the previous year. Neither market was quite as firm for Amraoti and Sind cotton as in the preceding year, the quotations for 1881-82 being below those for 1880-81."

There were 49 cotton mills working and in course of construction in the Bombay presidency at the end of June 1882, against 42 in the previous year. The mills, it is said, find employment for upwards of 37,000 souls, and machine spinning and weaving is one of the most thriving industries in the presidency. The number of cotton presses working in 1881-82 was 247, of which 90 were worked by steam power and 157 by manual labour. The number of bales pressed by the cotton presses in work in the town and island of Bombay amounted to 500,274, against 359,724 in 1880-81.

In regard to certain remarks which Mr. Pritchard makes, to the effect that adulteration of cotton is increasing since the repeal of the Cotton Frauds Act, the Bombay Government observes that "the repeal of the special Act for the prevention of cotton frauds was forced upon Government, as its enactment had been demanded by what was understood to be a general consensus of mercantile opinion, and Government cannot be expected to re-consider the question except on the strongest proof that the repeal of the Act has led to frauds so extensive that, in the public interest, renewed interference is necessary and is demanded by the general opinion of the mercantile body interested in the question; but a question of such vital importance to the trade of the presidency will not be considered closed, while there is room for any doubt whether the mercantile community was right in pressing for a repeal of the Act."

COTTON IN HYDERABAD.

THE cotton report of the Hyderabad assigned districts for the year 1881-82 shows that the area under cotton cultivation has risen from 1,767,851 acres in 1873-74 to 2,189,688 acres in the year under report. Compared with the results of 1880-81, the area in 1881-82 shows an increase of 433,742 acres. The great falling off in the area of the preceding year is, however, explained by the fact that the fields had to be re-sown two or three times, and even then they are stated to have sometimes failed, owing to the light rainfall at the beginning of the monsoon. The area of 1881-82 is distributed in the following proportion between each district:—

	Acres.
Amraoti	489,917
Akola	590,107
Ellichpore	258,520
Booldana	314,614
Woon	297,654
Basim	247,876

The proportion which the area under cotton bore to the total area under crop in each district is given as follows:—

Amraoti ...	34·2	Booldana ...	26·3
Akola ...	44·4	Woon ...	28·9
Ellichpore ...	41·7	Basim ...	23·0

Of the different varieties of cotton cultivated in the provinces, we find the ordinary *bani* occupying an area of 1,483,803 acres, the ordinary *jari* an area of 673,408 acres, the Khandeish cotton an area of 17,743, American cotton an area of 13,592 acres, and Hingunghât cotton an area of 142 acres. The quality of the crop is reported to have been above the average, while the quantity was also ordinarily large. The average out-turn per acre for the six cotton districts varied from 9½ seers in Basim to 39 seers in Woon. The total production of the year in uncleaned cotton is shown as 5,637,652 maunds, and the total outturn of cleaned cotton as 1,409,413 maunds. The local administration is, however, inclined to think that the production of cotton has been under-estimated. The total exports of the year by road and rail amounted to 1,572,052 maunds, and the total imports were 56,844 maunds. Of the total exports, Bombay took 315,940 bales of 3½ cwt., the North-Western Provinces 4,083 bales, and the Central Provinces 3,214 bales. The stations from which cotton was chiefly exported during the year were Amraoti, Murtazapore, Akola, Shegaon, Khangaon, and Malkapore, the exports from these places amounting to 323,237 bales. The average ruling price of cotton varied from Rs. 15-5-0 to Rs. 18-8-0 per maund of 40 seers. The average rate prevailing during the year was about Rs. 17 per maund. It is remarked that it has not been possible to ascertain to what extent the villagers sell their cotton at the large markets, and to what extent they dispose of it to village buyers. It is believed, however, that the latter course is being more and more adopted every year.

The cost of cultivation, including rent, is estimated to be about Rs. 4-8-8 per acre, and the total value of cotton, including seed, to be Rs. 19-8-8, thus leaving a net profit of Rs. 15 per acre to the cultivator.

The imports of rubber only amounted to 959 maunds against 1,228 maunds brought down in 1880-81, and was valued at about Rs. 40 per maund. The hillmen are said to have nearly exhausted the supply by reckless tapping of trees. The trade with Munipore has fallen off considerably during the year under notice. The imports reached a value of Rs. 28,812, against Rs. 26,110 in 1880-81, while the value of the exports was only Rs. 33,951, against Rs. 1,26,038 in 1880-81. The decrease in the exports occurs almost entirely under cotton piece-goods (European) and cotton twist. The falling off in the demand is, it is believed, due to the fact that the large quantities of cotton goods and twist which were exported during 1880-81, must have also have been deemed sufficient for the requirements of 1881-82. It appears that the Manipooris, in order to save the cost of conveyance, which, owing to want of proper roads, is not small, take large quantities of articles at a time, and keep them in store for future use.

We observe that sixteen steam cotton presses were at work during the year, the number of bales turned out by each press being as follows:—

	Bales.
Volkart United Press Co., Ld. ...	25,931
Mofussil Company, Limited ...	21,109
New Berar Company, Limited ...	22,133
Harvey and Sabapathee ...	11,434
West Patent Press Company ...	13,468
Mofussil Company ... / New East India Company ...	26,511
Akola Press Company ...	16,056
Harvey and Sabapathee ...	4,000
French Press ...	25,903
Graham and Company's Press ...	14,323
Mofussil Company's Press ...	23,127
New Berar Company's Press ...	16,301
Hidyert's Hydraulic Press ...	20,864
Ralli Brothers' Press ...	30,000
New Berar Company, Limited ...	7,543

EDITORIAL NOTES.

THE Government of Madras has recently published a report of the visit of a party of ryots from Villupuram in South Arcot to the Government Agricultural Farm at Saidapet, which is very interesting, as illustrating the impression derived by the ryots from a personal observation of the working of the different kinds of ploughs, the various kinds of machinery, and after a careful inspection of the several experimental crops grown on the farm. Of the several ploughs which were tried before the visitors, they fancied three kinds, *viz.*, the Ransom wooden stilted (one stilt), the improved country plough wooden stilted, and the Swedish plough (one stilt), and consider that the

last named works much better than the one of the same class that has double stilts. They have asked to be supplied with a specimen of each of the three ploughs referred to, together with a light drag harrow which was shown them, and which they are anxious to try. It is their intention to have a number of ploughs manufactured of the three specimens which have most pleased them; these will be made of country wood and iron, and turned out by their own village artisans. Of other agricultural implements, the ryots have expressed a wish to be supplied with two "breaking machines of ground-nut cakes."

Amongst the live-stock of the farm, a good bred ram, with the longest tail and big head, has been asked for by some of the party for purposes of breeding. Others have taken a fancy to a Kerry cow, and a bull brought forth by it, and it is perhaps likely that they may be sold to the ryots wishing to have them. As regards the experimental crops on the farm, we observe that a quantity of guinea grass, which was shown to the ryots as being fit fodder for cows, has been asked for with the view of planting them in reserved tracts of their holdings. A number of trees of the manilla hemp is also to be supplied for purposes of experimental cultivation. A crop of the New Orleans cotton, which was inspected by the party, has also taken the fancy of some of the men, and they have asked for seed in view to try its cultivation in Villupuram. A water lift, drawn by a single bullock, was fancied by two of the party, and they wish to have it manufactured of country wood by the aid of a skilled person to be deputed from the farm to Villupuram. The ryots, it is said, were also anxious to try the cultivation of Chinese sugar-cane and the amber sugar-cane. Some of them are of opinion that these two varieties, more or less resembling a *cholum* crop, will be best suited for cultivation in South Arcot soils, although others are doubtful on the point. The following were selected by the ryots from the botanical portion of the farm, as the most fitting objects for trial in Villupuram:—

TREES.

1. Eucalyptus bicolor.
2. Do. rostiata.
3. Do. sidrophlio.
4. Do. gonicalyt.
5. Pandanus odoratissimus.
6. Acacia proslanthera.
7. Mahogani.
8. Anogeissus acuminatus.

FLOWER KINDS.

1. Bougainvilleæ spectabilis.
2. Porana volubilis.

The Madras Government, in its remarks on the report of the visit, trust that this will induce others to come and see what the farm is doing, and to adopt its improved methods and accumulated experience, to their own and the country's very great advantage.

PROFESSOR COMSTOCK says the most satisfactory remedy for scale insects is concentrated lye, one pound to one gallon of water. It does not injure the fruit buds, and most effectually destroys the scale insect. Whale-oil soap and sulphur mixture is a good remedy in summer, in the proportion of one pound of soap to one gallon of water. The application of the remedy to small trees is an easy matter. For large trees a bamboo rod ten feet long, with spray-tip nozzle, has proved of great value. This rod may be attached to a force-pump. In fighting scale insects on shrubs and trees all efforts to destroy them by poisonous fumes and by powdered substances have proved unsuccessful. Pyrethrum has done more harm than good by killing useful parasites in large numbers, with no appreciable effect on the scales.

AT the last meeting of the North American Bee Association, a committee was appointed to gather statistics. It is believed that full statistics as to the number of colonies of bees and the product from them will surprise everybody, and lead apiculture to be better appreciated as one of the important industries of the country.

FROM a paper upon "Breeds of Sheep and their Origin," read before the State Wool Growers' Association, by the Hon. Robert Mitchell, of Princeton, Ind., we gather that the original importation of merino sheep into the United States from Spain, included all the most prominent Cabanas of that country. But, as a general thing, the different families, even when preserved pure from foreign admixtures, were crossed promiscuously with each other. The Saxon, French and Silesian merinos were of later importation. Of the original Spanish stock but two are now represented by distinct families, namely, the infantado and the paular. These sheep, originally imported by Colonel David Humphreys, of Connecticut, have been preserved pure to the present day. They are a fourth, if not a third, heavier than their Spanish ancestors, and are the largest family of American merinos. It may not be out of place here to give a short history of how the first Spanish sheep were brought into the United States. The following is from the pen of Mr. William Jarvis:—

"In 1801, General Humphrey, being then minister plenipotentiary at the court of Spain, purchased 200 of these sheep in that country and shipped them for their place of destination. They arrived in the spring of 1802. It seems to have been a custom at the Spanish court, when a foreign minister was recalled, on taking leave, a present was made to him of five or ten bars of gold, each bar weighing a pound, or thereabouts. But, as the law of his own country forbids any minister taking presents from a foreign government, he declined this overture, and suggested to the Spanish minister that royal license be granted to take out of the kingdom 200 merino sheep, which would be a great gratification to him. This the Spanish minister stated could not be done, but internoted to the general that if he wished to take them out, no obstruction should be thrown in his way. The sheep were accordingly procured and forwarded."

ALTHOUGH great efforts have been made, says the *Farmers' Review*, during the past few years to increase the supply of cattle for market, and large amounts of capital have been invested in ranches, and stock cattle in the South-west, North-west, and far West, extending from Texas to Oregon, from which we are already receiving liberal returns in the shape of fat beef cattle, many of which compare well with the grain-fed stock of the older States, the demand has responded so closely to the increased supply, that there is often cause for complaint in regard to the scarcity of desirable stock with which to supply the demand. This scarcity of fat cattle is largely attributable to the rapid growth of the population of the country, in connection with the wonderful development of our foreign export trade in dressed beef and live cattle during the past few years. The business of canning fresh beef, which was scarcely known a decade since, is now a prominent factor in the cattle market, the takings by Chicago canners being estimated 4,000 to 5,000 head per week. The goods thus put up find their way to all the leading countries of Europe. They also constitute the chief article of meat used in the far Western and South-western mining camps, where it would be impracticable to handle fresh beef, even if it could be had, and in many localities it would be impossible to obtain it. The mining camps of old Mexico are also largely supplied with canned meats from Chicago and other cities. Canned beef is rapidly superseding the salt junk which for ages has been a leading factor in vessel supplies. It will therefore be seen that the steadily increasing outlets for fresh beef promise to keep pace with the production, hence there is little cause to fear that the efforts now being made to increase the supply of beef will, in the near future, over-stock the market to such an extent as to cause prices to drop to figures that will not only, as some predict, render the business of raising beef cattle unprofitable but involve those who engage in it, in financial ruin.

THE island of Jersey, having a surface of seven miles each way, keeps 12,000 cows. The breeding of cows has made the island very fertile; as the animals are kept in stables all the year round, every particle of the manure is saved. In winter they

are largely fed on parsnips, which has probably helped to develop the butter superiority of this breed of cattle.

MR. J. T. ALLEN, of Omaha, has presented some large figures as to the cattle-raising capacity of Nebraska. It appears that during the past year 90,000 steers had been shipped East from there, and that there were now 300,000 head of cattle grazing in the western part of the State. He estimates that the lands west of the Missouri river would support 5,000,000 cattle and 10,000,000 sheep, and supply for shipment yearly 650,000 cattle, 1,500,000 sheep, and 50,000,000 pounds of wool. He stated that the expense of raising a 1,200-pound steer was $6, and that the entire cost of the animal delivered in Chicago was $11.

MR. HUGH CLEMENTS, writing on the cost of cultivation in England, says:—From the average cost of the various items making up the total cost of the production of the several crops raised, which I have calculated, it will be found that the expense incurred in the cultivation of the land is excessive in many parts of the country, and does not produce an extra return at all proportionate with the increased expenditure. In England the average cost per acre for gross rent for the growth of wheat is about £1 18*s.* 7*d.*; for seed, 14*s.* 7*d.*; for manure, £1 14*s.* 8*d.*; for cultivation by hand or steam power, including harvesting, £2 3*s.*; for labour, including thrashing and marketing, 17*s.* 8*d.*; and for sundries, including tradesmen's bills, &c., 4*s.* 5*d.*—making a total of nearly £7 13*s.*

In Lincolnshire, farmers can apply 30*s.* worth of manure per acre, and raise wheat at a cost of £7 2*s.* 10*d.*, including charge for interest at 7½ per cent.: in north-west Suffolk the same can be done for £6 12*s.* 3*d.*; at Darlington, Yorks, for £6 10*s.* 7*d.*; and the fallow crop in Huntingdon costs £7 1*s.* 11*d.*, while that at Darlington amounts to £10 1*s.* 2*d.*: but this latter estimate might economically be reduced by 20*s.* on ploughing and harrowing, 15*s.* on manure, and 5*s.* on gross rent, bringing the sum down to £8 1*s.* 2*d.* Taking £7 as the fair charge for the cultivation of wheat in rotation, I find that the small proportionate amount of fallow wheat should only raise that average to £7 12*s.* 6*d.*, which is virtually equal to the sum of £7 12*s.* 10*d.*, the average obtained from the actual cost incurred in every part of the country. At Woodbridge, in Suffolk, the cost is £10 7*s.* on a mixed soil, and only £7 5*s.* on heavy land, there being £3 more manure applied in the former case, as well as 5*s.* more for seed, and nearly double for labour, including that of thrashing and marketing. At Reigate, in Surrey, £14 6*s.* 6*d.* is spent per acre in the production of fallow wheat on clay land, being £6 13*s.* 8*d.* above the general average, £4 being readily accounted for by excesses of at least £2 7*s.* in manure, 17*s.* in cultivation, including harvesting, and 16*s.* in gross rent, £10 6*s.* 6*d.* being ample for the production of wheat on the soil referred to.

The average cost of the production of barley per acre is about £6, made up of £1 16*s.* 7*d.* for rent, including rates and taxes, 12*s.* 11*d.* for seed, 15*s.* 9*d.* for manure, £1 14*s.* 7*d.* for cultivation, 16*s.* 3*d.* for labour, and 4*s.* for sundries. But I consider this average about £1 too high, there being no additional return at all equivalent to the increased expense. In Durham a good deal of barley is raised at from £3 12*s.* to £4 12*s.* per acre; in York, from £4 to £5; in Rutland, from £4 10*s.* to £5; in Lincoln, from £4 to £6, in Hants and Dorset, from £3 10*s.* to £1 10*s.*; but in many parts of Yorks, Lincoln, the other eastern and southern counties of England, the cost mounts up to £6, £7, and £8, and in some cases to nearly £9, the average charge in Kent being about £8 3*s.* 4*d.* per acre. The average spent in manure per acre is about 15*s.* 9*d.*, but we have in some cases in Durham, 30*s.* and 50*s.*; in Yorks from 20*s.* to 60*s.*; in Lincoln, from 20*s.* up to even 80*s.*; in Wilts, 15*s.* to 20*s.*; in Kent, from 25*s.* to 40*s.*; in Hants, 20*s.*; in Devon, 25*s.* to 40*s.*; and in Cornwall, from 10*s.* to 50*s.* There seems to be great extravagance in manuring for barley, and as far as this crop is concerned, the results, as shown in the yield, are not so apparent as might be expected, for it often happens that the produce is as much, if not more, without the misapplication of manure. The manure may be and doubtless is often, beneficial to succeeding crops, and in keeping up the efficiency of the soil: but from an examination of the table given, it would appear that a large expenditure on manuring for barley is not justified by the results. There is little or no application of manure to barley taken after turnips, but there usually is when following a wheat crop. On a farm in Lincolnshire £1 10*s.* is spent in manuring after turnips, and £4 after wheat. Again, the amount spent in cultivation and labour might in many instances be reduced from 10*s.* to 20*s.*, and even £2 per acre without seriously impairing the result.

The average cost for the production of an acre of oats is made up of £1 14*s.* 2*d.* for rent, rates, and taxes, 12*s.* 9*d.* for seed, 16*s.* 6*d.* for manure, 31*s.* 2*d.* for cultivation by hand or steam power, including harvesting, 14*s.* 9*d.* for labour, including thrashing and marketing, and 4*s.* 3*d.* for sundries—giving a total of £5 13*s.* 6*d.* With regard to the table for oats, much the same may be said as to the extra expenditure incurred in raising the crop as in the case of barley.

GRAIN EXPORT FROM NEW YORK.—The grain export from New York during the year 1882, the returns of which have been published, present some remarkable features. The steady decline of shipment by sailing vessels in the last few years is most noticeable. In 1880 the exports by sail were 63,376,000 bushels, by steam 49,996,000 bushels. In 1881 the export by sail were 19,007,000 bushels, by steam 53,552,000 bushels. In 1881 the American wheat and corn crops were both short, and as a consequence, the exports of 1882 were thereby materially affected. The sale shipments for that year were 6,284,289 bushels, while those by steam were 39,878,449 bushels. After making due allowance for the shortage of 1881 in its effects on the exports of 1882, the conclusion is evident that steam will expel the sailing vessels from the grain trade. Another important fact to be noted is, that not a single bushel of grain was shipped to Europe from New York during the year 1882 in a vessel under the American flag. Out of a total of 46,162,738 bushels, 26,694,846 were shipped in English vessels in 1882.

THE exports of wheat, and wheat in flour, from all American ports to foreign countries, from Sept. 1, 1882, to March 31, 1883, inclusive, being the first seven months of the export year of 1882-83 (crop year), aggregated 92,740,000 bushels, an average of 13,248,571 bushels per month. The same ratio for the remaining five months ending Aug. 31 would give an average for the year of 158,982,852, bushels. It is more than likely, however, that the exports will average much higher during the last five months of the year, as such is usually the case, especially in years when, as is now the case, the estimates place the growing crops of Europe as likely to fall below the usual average, as millers and dealers there take the timely precaution to secure good supplies in advance.

PROFESSOR W. A. HENRY, of the University of Wisconsin, has made the following report on a sample of sorghum sugar submitted to him:—

The sample was manufactured from amber-cane grown on the experimental farm in 1882. The data of the largest plat of cane made into sugar this year, is as follows:—

Area of plat	3 3·5 acres.
Weight of stripped cane	75,262 pounds.
Per cent of cane sugar in juice ...	9·89
Per cent of glucose in juice	3·95
Amount of sugar separated:	
First crystallization	2116½ pounds.
Second crystallization	830 „
Total amount of sugar	2,946½ pounds.

Syrup drained from the sugar, 315 gallons.

Seed obtained, 76 bushels of 51 pounds each.

The cost of manufacturing the unrefined sugar was, for all expenses, including the cost of the cane, but excepting the pay of the chemist in charge, 4½ cents per pound. The value of the cane seed is not taken into account in the above estimate.

As the means of refining were very imperfect, the samples sent out vary greatly in color; some are nearly equal to light "Yellow C" in color, and appearance, while most are brown in

From the Director of Agriculture and Commerce, North-Western Provinces and Oudh, to the Secretary to the Government of the North Western Provinces and Oudh,—No. 403A, dated Allahabad, 17th March 1883

I have the honor to acknowledge receipt of your letter No. 312, dated 5th February 1883 (Revenue Department), calling for a special report on the sorghum sugar experiments of this department, and in reply to report as follows —

The field selected was manured with farm-yard manure and cultivated in the ordinary manner. It was divided into three sections, in which were respectively sown—

1st.—Early Minnesota amber cane received from the Government of India, a variety which bears the palm in America.

2nd.—Amber cane or red sorghum, from seed of last year's farm crop.

3rd.—Black sorghum.

In every way these crops were treated like an ordinary crop of *juar*. The field, however, proved to be too low; and with water standing on it for some time in July, the crop proved a poor one, and not nearly so good as another crop of sorghum grown for fodder, only on land higher and unmanured. The low-lying crop also was much damaged by the "makai" grub which does so much injury to maize.

The experiments were directed solely to procuring the best possible sample of crystallised sugar in the compost form (goor). So far as could be understood from the reports received from other parts of India, no saleable goor had yet been made, and even in America the manufacture of anything but syrup would seem to date from about 1881.

Experiments were tried with various re-agents for defecting and clarifying the juice which is intensely acid, much more so than that of sugarcane.

Canes were cut at various stages of growth to ascertain the most profitable period.

Canes were ground with the leaves on to economise the labor for stripping.

The worm-eaten canes were excluded. So a great deal of the crop was used to gain experience, and scarcely as much was used in the manufacture of the best samples as would warrant the building up thereon of a commercial scheme. For this another season or two must be awaited.

The best results were arrived at by stripping the canes in the field, carrying them straight to the mill as cut, putting them through a Behia mill at once, and boiling the juice in one pan, as soon as removed from the mill. The best time for cutting the canes is when the seed is in the dough stage. The head of seed is cut off with the top short, and left in the sun to ripen, the whole of the seed being saved. As economy is a great point, a portable mill that can be carried to the field is a desideratum. Fermentation converts crystalisable sugar into uncrystalisable. So does the acid in the juice at high temperatures. Fermentation is set up in the juice on exposure to the air, hence the necessity for getting the canes pressed and the juice neutralised as quickly as possible after cutting. To prevent fermentation also, the mill, boiling pan, and vessel for holding the juice as it comes from the mill were daily fumigated with a few sulphur matches.

A few drops of castor oil were sprinkled on the juice as it approached boiling point to aid in clarification, and at boiling point milk of lime was added carefully to a point close on neutrality.

The scum, as it rose, was carefully removed and the juice concentrated down to the proper consistency for goor. A small quantity of "rab" was made from which drained crystals were obtained as a sample; but attention was chiefly concentrated on making goor.

The above details show no difference from those of the process of manufacturing goor from sugarcane, as now practised by many manufacturers. It is only given in detail because, although goor may be made from sugarcane juice, without using lime, a skilful native sugar-boiler entirely failed in operating on sorghum juice without lime, and for the black sorghum the failure was maintained even with lime, until a small quantity of carbonate of soda, or sajji, had been added as well as the lime.

Taking an average, the result was as under :—

Outturn per acre.

		Mds.
1.	Weight of plant	125
2.	,, of cleaned canes	52·27
3.	,, of goor	4·44
4.	,, of grain	3·00

Cost per acre.

Cultivation.	Mds.	Rs.	A.	P.
Manure	100	3	0	0
Ploughings	2	1	8	0
Crushing clods		0	4	0
Sowing		0	12	0
Seed		0	4	0
Weeding (once)		2	0	0
Cutting		2	8	0
Rent (kharif)		4	0	0
Boiling juice @ Re. 1-12 per maund		7	14	0
Total ...		22	2	0

Value of produce per acre.

	Rs.	A.	P.
Goor @ Rs. 4 per maund	17	12	0
Grain @ Rs. 0-12 per maund	2	4	0
Tops and leaves of fodder @ 10 maunds per rupee ...	9	8	0
Vinegar	1	0	0
Total ...	30	8	0

The analysis, by Messrs. Carew and Company, Limited, of a sample, was as under :—

Cane sugar	61·00
Glucose	23·85
Moisture	7·99
Ash	3·15
Unknown	4·01
Total ...	100·00

This analysis shows for refining purposes an objectionable amount of glucose and a larger amount than was present in a sample of sorghum goor manufactured this year, also, at the Aska Sugar Works* in Madras. The sugar would clearly be more suitable for brewing purposes than for refining purposes so far as export is concerned. But a peculiarity of glucose sugar is, I believe, its similarity in taste to honey, a taste which was very marked in some samples of the sorghum goor, and which seems to be to the liking of the people. Coming as it does out of season and forming a good eating goor, there is testimony from both Carew and Company and from Messrs. Thomson and Mylne that it would fetch a top price in the market. It may possibly then become at least as popular for eating as sugarcane goor, and so free a large quantity of the latter for export, particularly, if, as may be hoped, further experience will lead to further improvement.

* Cane sugar	74·00
Glucose	9·42
Moisture	4·52
Ash	2·26
Unknown	9·8
Total	100·00

NOTE.—In the original Aska analysis, "salts" and "ash" are given separately. Not understanding how the analyst arrived at such a result, I have put the analysis in the form usually used abroad.

Sorghum requires no irrigation nor does it require much manuring. It can be grown on high light land which grows ordinary kharif crops, and has in America been cultivated year after year on the same soil without deterioration. The seed is all saved and is good food for man or cattle, while the tops, leaves, and begass are all eaten greedily by cattle. It is worth then the closer attention of Indian agriculturists; and a large supply for distribution should be indented for of the best early amber variety from America against the coming kharif season.

INDIAN TRADE WITH AUSTRALIA.

THE following note, drawn up in the Revenue and Agricultural Department of the Government of India, has been published by the Government of India :—

The active co-operation of the Government in the promotion of Indo Australian trade, commenced at the Melbourne Exhibition of 1880, has now almost been brought to a close in the despatch of a final consignment to Sydney of Indian goods likely to meet Colonial requirements. These are consigned to the late Commissioner at the Melbourne Exhibition now resident at Sydney, the capital of New South Wales. The success of Indian exports in the market of Victoria, of which Melbourne is the capital, has been undoubted. Before 1880 the trade with Melbourne consisted mainly of raw jute, jute goods, castor oil, and rice. Exclusive of these and of tea, which then, however, formed a very small portion of the exports, the Indian consignments received at Melbourne were valued at Rs. 1,61,678. In 1882 their value was estimated at Rs. 5,43,355, or Rs. 3,81,677 in excess of the value of 1880. The goods exported through the Exhibition Agent, who after the Exhibition remained in Melbourne for the purpose of pushing the Indo Australian trade, were alone valued at Rs. 1,67,066 in 1882. A very large increase is taking place in the current year. The impetus given to Indian exports is to no small extent due to the success of tea, in the wake of which the minor articles of commerce have followed. Tea exports rose from less than a lakh of pounds in 1880 to over two millions in 1882. Other lines in which success has been prominent are soft goods, myrabolams, skins and hides, unrefined sugar, &c.

The demand for hides and skins in Australia, a country in which cattle and sheep abound, appears remarkable, but is due to the fact that Australian hides are too good for many purposes for which Indian hides are required. The latter are used, for instance, in making the upper parts of boots worn by the middle and lower classes, for which purpose also they are exported in large quantities to Europe. "Spices and Condiments" is not an entirely new line of trade, but has been extended by the Exhibition. Tanning materials are likely to find an increasing market in consequence of the exhaustion of forest products in Australia itself.

Certain of the cotton goods which the Melbourne Commissioner took considerable trouble to place before the Australian houses have found favour, and some classes of the Bombay mill hosieries

are likely to meet with considerable sale. A valuable market has also been found for a new class of jute goods, to meet which new machinery has been set up in more than one mill.

In consequence chiefly of the magnitude of the trade in jute bags, in which the Australians pack their wheat and wool for export to Europe, there has always been a very large excess of exports to Australia over imports from that colony. The increase in exports, therefore, however satisfactory, is not likely to assist in leading to the increase in direct shipping communication with Australia, unless some return trade is thoroughly established. The Australians do not send much to India now, except horses and metals. It is doubtful if there is anything else in the colony which they can afford to send to India in any quantity, except perhaps timber and ghee. The high price of labour precludes their competition in India to any manufactured article, or any production in which human labour is an important element. On the other hand, wool is at present not required; while frozen meat, butter and preserved fruits would only meet a small demand from the European population, and perhaps of a few wealthy sections of the native community. Timber might, however, be taken for public works, while the whole native population is a customer for ghee.

The quantity of the latter article consumed in British India, exclusive of Natives States is estimated by the provincial authorities at considerably over five million cwts. per annum, the value of which is about fourteen millions sterling. The price of ghee is gradually rising, owing to the continuous decrease of grazing land and the greater profits derived from the cultivation of produce. There is, therefore, some hope that the import of ghee from Australia, if once introduced, will meet a constantly rising market, and become more and more profitable.

The price now ranges between 5*d*. and 7*d* a pound; but first-class ghee sometimes fetches in the Bombay market as much as 11½*d*. a pound.

The attention of the Government of India is now confined to the import question. Unless a return trade from Australia can be found, the shipping rates will do much to handicap the extension of the export trade and curtail the Australian demand for Indian goods. One experiment has already been tried for the purpose of solving the ghee question. Two ghee-makers were shipped to Victoria; but the landowner to whom they were consigned found the adjacent butter market at Melbourne to be so lucrative that the ghee-makers' labour was quickly confined to the manufacture of butter. The experiment is now to be repeated on the condition that the labour of the ghee-makers shall not be diverted to other purposes. But it is in New South Wales, in that part of the country to which emigration is likely to be established, *viz.*, in the tropical regions on the north coast of Australia, that the industry is most likely to take root, and further experiments will be tried therefore on this occasion in the northern tracts of South Australia. In the meanwhile, it is anticipated that some samples of Australian ghee, with statistics of the cost of production, will be forthcoming at the Calcutta Exhibition.

SELECTIONS.

THE VITALITY OF SEEDS

AUTUMN is the natural season for the study of seeds. But most of us have our attention more particularly drawn to them in the spring; and in the months of March and April most amateur gardeners get their only personal knowledge of these mysteries of creation. Among the questions that are pretty sure to crop up in many an amateur's garden at this time of year are, whether the remnants of last spring's seed packets will do to sow this year, and how long may seeds be kept before losing their vitality. This opens up rather a wider field for investigation than would, perhaps, be supposed by those who have never given any attention to matters of vegetable physiology. As a rule, no doubt, most of the seeds which amateur gardeners are likely to have should be last autumn's. But seeds vary immensely in their vitality. Everybody has heard perhaps rather too much of the mummy wheat, which has been declared, seemingly on good authority, to have germinated after having lain in the palm of a mummy ever since the body was embalmed, perhaps 3,000 years ago. That idea, however, has now been very generally exploded. There can be no doubt that there was some want of care in the observations which seemed to establish it. This, however, is not the only observation of the same kind that has been adduced in proof of the indefinite vitality of some seeds. Dr. Lindley, for instance, the well-known botanist, says in one of his works, "I have at this moment three plants of raspberries before me, which have been raised in the garden of the Horticultural Society from seeds taken from the stomach of a man whose skeleton was found thirty feet below the surface of the earth, at the bottom of a barrow, which was opened near Dorchester. He had been buried with some coins of the Emperor Hadrian, and it is therefore probable that the seeds were sixteen or seventeen hundred years old." That statement also has, we believe, been rejected as the result of observation not sufficiently guarded, and it may, we suppose, be considered as generally improbable that seeds ever have the capability of germinating after the lapse of any such period. At all events we have no well authenticated proofs of anything of the kind, though such alleged facts as that to which Dr. Lindley testifies have had the support of very credible witnesses. "The preservation of vitality," says an authority, "depends upon the stability of the chemical compounds of which they consist. This appears to be the hinge upon which everything turns." A further truth seems to be that the process of ripening is one which results in this stability. Oxygen is the great agent of change, whether of germination or decay, and a ripe seed is one which has been fortified against the action of oxygen. In some seeds this process appears to be more complete than in others. Even when fully ripe, nuts and acorns have a greater affinity for oxygen than corn, or peas, or holly berries. Nut and acorns, therefore, lose their vitality more rapidly than any of the latter. In some seeds the ripening process appears to do very little towards fortifying against the all destroying oxygen. It is said that coffee berries, for instance, lose their living principle if not immediately planted, when they become fully ripe, and the same thing has been affirmed of magnolia seeds. On the other hand, all kinds of cereals appear to perfect their ripening process very completely under favourable conditions, and hence preserve their power of germination for a long time. Maize has been grown after lying by for twenty-five or thirty years; rye for forty years; and wheat—leaving out of consideration the gift of the mummies—has been known to yield a good crop after considerably longer than that. Dr. Lindley says that the seeds of the sensitive plant will keep for forty years, and kidney-beans for a hundred years. It has been recorded that, after the great fire of London, the ground cleared by the destruction of the buildings soon became covered with plants of a kind unknown, or very uncommon, in London previously; and prairie fires in America have been observed to have been followed by a similar phenomenon. Some have explained this—though there certainly appears to be no great probability in the theory—by supposing it due to the fact that seeds had been overbuilt or overgrown, and thus shut away from the vitalising action of the air, and that, when the ground was cleared above them, their suspended animation re-asserted itself, and they started into life. There would seem to be more probable ways of accounting for such a phenomenon, though it seems to be indisputable that good reason has occasionally been found to believe that seeds have been thrown up from a considerable depth in the soil, and have at once germinated, their vitality having apparently been suspended by burial. Amateur seed sowers should make a note of this. A very common mistake is that of burying seeds too deep in the soil. They get moisture, but they get too little sun and air, and fail to germinate. Usually no doubt they die, but it may be that some of the more enduring kinds may start into growth on being subsequently turned up to the surface, and it may be that the plentiful crop of weeds that will often overspread a newly dug plot of ground within a very short time, may be accounted for in this way. A very curious fact was vouched for many years ago, which has an additional interest now, that electricity seems to be invading every department of activity. It was found that a galvanic current had a decided effect in the germinating of seeds—that seeds at the negative pole of a battery germinated much more freely than those round the positive pole. But what is far more singular than this is that, according to very respectable authority, the radicals of seeds made to germinate at the positive poles grew upward instead of downward—the current made them grow bottom upwards. Professor Renfrey, who mentions this, refers to a number of experiments carried out with the definite object of ascertaining how long seed may be kept with a probability of their growing. Out of 368 species tested by De Candolle, there were only seventeen that grew after a lapse of fifteen years. Out of 188 genera tried under the auspices of the British Association, it was found that the majority had lost their vitality altogether at the end of ten years. Thirty four species retained a capability of germinating after ten years, twenty species after twenty years, and only two after forty years. As a general rule, there can be no doubt that Nature knows pretty well what she is about in shaking down her seeds as soon as they are ripe. They deteriorate by being kept. So far as the floriculturist is concerned, however, there would seem to be some exceptions. Balsam seed, for instance, is thought by many growers to produce more double blossoms by being kept for a time. As a rule, however, old seeds should not be relied upon, and, though it is to be feared that most of the seed packets have a certain proportion of old stock, we suppose that many dealers will satisfy any little qualms of conscience with the reflection that most amateurs are given to sowing their seeds too thickly.—*Globe*.

INDIAN AGRICULTURE.

IN what manner shall a rapidly increasing population derive sufficient sustenance from a deteriorating soil? To the solution of this problem Lieutenant Frederick Pogson, H. M.'s Bengal Army, has applied himself with much intelligence and assiduity.* He is encountered, however, by two enemies—the apathy of the Government, and the prejudices of the people. Again and again, he has placed important information at the disposal of the Government, but only to find his warnings neglected, his good advice treated with indifference. The value of a rich opium crop, one would imagine, must be pretty well established by this time, and yet no attention has been paid to a pamphlet published in 1871 by Mr. Phillips, a landholder in the district of Fyzabad, in which were pointed out the great advantages he had derived from the use of a particular manure recommended by Mr. Pogson, who had officially communicated his formula to the local Government. Experience also has shown that the poppy is far more vigorous and hardy when grown on hills, and that Himalayan opium contains twice as much morphia as the best produce of Benares and Patna. Nevertheless, the cultivation of the plants is virtually confined to the plains, where the requisite iron, potash, and nitrogen are inadequately supplied by the soil, and to provide which was the object of Mr. Pogson's slighted receipt. In like manner, no

* *Manual of Agriculture for India*. By Lieutenant F. Pogson, H.M.'s Bengal Army. Thacker, Spink & Co.

official steps have been taken to encourage the cultivation of the Chufas, or *Cyperus esculentus*, which, although imported by the Agri-Horticultural Society so far back as 1837, does not yet possess a Hindoo name. It is the well known ground nut, so popular in the United States and in Spain as food for human beings, as well as for sheep, cows, oxen, and pigs. It is described as extremely prolific, a single nut yielding from two to four hundred. In flavour it resembles a cocoanut, with a taste of almonds when the tubers are ripe and dry. A still more striking example of bureaucratic superciliousness is to be found in the stupid neglect of the immense deposits of fossil bones in the Sewalik range. The natives who, if Hindoos, can hardly be prevailed upon to touch bone-dust, do not object to handle the phosphatized bones dug out of those mountains, probably from not understanding their real character and origin. The one thing needful is the construction of cart roads, but hitherto Government has apparently had no time or thought to bestow on such vulgar details. The Hindoos are equally averse from using night-soil and liquid manure, and thus abstain from employing the means immediately at hand for the regeneration of their exhausted soil. Mr. Pogson is severely logical in rebuking the Hindoos for their laudation of the cow as a universal purifier, and yet refusing to make use of the animal for the purification of bone dust and other artificial manures held to be "common and unclean." His advice, however, may be profitably followed by both native and European agriculturists, for it is eminently practical and devoid of empiricism. His little volume, indeed, embodies teachings of a large and varied experience, and deserves to be warmly supported by the Government.

The food question, indeed, is beginning to cause anxiety in almost every region of the globe. Even the Americans are watching with disquietude the rapid absorption of culturable land by immigrants from Europe. The present system of agriculture in the United States, if such it can be called, where the soil is left to itself, is excessively wasteful and exhausting. So long as the virgin soil will go on yielding spontaneously, the danger of diminution in the supply of cereals cannot be imminent, but as soon as manure is wanted, the decline will become visible to all men. The American farmer is not generally a stock keeper, except on dairy farms, which, of course, produce little in the way of corn. But without stock it will be necessary to have recourse to the artificial manures which need to be applied with thought and discrimination. There is a very general belief that the prevalence of pleuro pneumonia is partly and even largely due to the excessive or injudicious use of artificial manures, uneducated farmers taking no heed of their component parts, or of the nature of the soil or crop to which they are to be applied. The Indian agriculturist who is willing to be guided by Mr. Pogson's advice, incurs no risk of the kind. He is not invited to purchase this or that compound, but is told in simple language, to be understood of all men, what he is to do for each particular crop, whether poppy or tobacco, maize, wheat, or barley, or any other form and fashion of field produce. He cannot go wrong unless he choses to follow his own judgment. In England the outlook is very disagreeable, alike for those who own, and for those who occupy land. Lamb for the present is tabooed, which deprives the farmer of his spring resources. Even mutton is growing scarce and dear. Old mutton such as our fathers loved has long been unobtainable. It is seldom more than one year old, and is consequently pale and flabby. It has deteriorated as much as the claret with which it was washed down. Charles the Second may congratulate himself that he lived at a time when sheep were grass-fed, and suffered to complete their fourth or fifth year. He would never have been a merry monarch, had he sat down to alternate courses of beef and pork, the one cut from an animal dying of consumption, and the other from an unclean beast swarming with trichinæ. The very grape refuses to make glad the heart of man. Phylloxera is a long and hard word for the million, but the disease appears to be as incurable as young love, and much more fatal. The vile concoctions of Spanish and Australian wines combined with slow poisons, that are now shipped from Bordeaux, mark not only the deterioration of the French vine, but also, what is far worse, the deterioration of the French character. Man must live, however, or thinks that he must, nor will he live on bread alone. With the diffusion of sound scientific knowledge, the earth will once more be compelled to yield her kindly fruits in due season, and in sufficient quantity for the maintenance of mankind. The period of trial and tribulation is generally brief, and is usually succeeded by long continuous happiness, especially in three-volume novels. Let us hope, therefore, that man will not be starved off the face of the earth, at least in our time; and in the meanwhile we may perchance postpone the evil hour by a careful study of Mr. Pogson's treatise.—*Madras Mail.*

ECONOMICAL USE OF TURNIPS IN THE FEEDING OF CATTLE.

MR. BRUCE, Collithie, read a paper on this subject at the last meeting of the Strathbogie Farmers' Club. After a few introductory remarks, Mr Bruce said:—If the same proportion of the acreage of the farm is to continue to be devoted to the growth of the turnip crop, I would suggest as an improvement on the present mode of its consumption that the whole of the crop be drawn for sheep, and the number of drills left to be regulated according to the quality of the soil and its need of the manure of sheep. A great drawback, and it is a serious one, to the consumption of turnips by sheep in this district, is the heavy rainfall and stormy nature of the weather generally. Owing to such adverse climatic conditions as generally prevail here in winter, prices for drawn turnips must be considerably lower than in other districts where a milder climate is enjoyed, and where the stock arrives sooner at maturity. And as the turnips are not worth so much to the flockmaster in this locality as in many others more highly favoured, owing to the same reason—the heavy rainfall and frequent snowstorm—it is highly probable that in even an average season the succeeding crops do not derive so much benefit from the droppings of sheep as they do in the more favoured localities. As prices as a rule may be expected to remain low—in fact seldom so high as sufficient to cover the cost of production, farmers have not the same encouragement to consume a part of the turnip crop on the ground by sheep as the farmers have, who live in districts where a dry climate is enjoyed, and which is so necessary to the speedy fattening of the fleecy flocks. However, if it be assumed that the manure left on the ground by sheep be worth to the succeeding crops about 30s per acre—which I believe it is—when the turnips are consumed on ground in suitable condition, a little encouragement appears, and it might be worth the attention of farmers to try the system on a more extended scale than has hitherto been done in this district, and carefully watch the results. For economical reasons the present system of consuming the turnips is ripe for change, and an alteration is due at an early date, but owing to a spirit of apathy, which unfortunately prevails in farming circles, and which is altogether hostile to agricultural progress, I fear the necessary reform which agricultural enterprise should achieve, will only be accomplished by stern necessity. Turnips could be much economized by pulping and mixing with chopped straw, but as this mode of preparation cannot be conveniently adopted on every farm for want of water power, and, as in too many cases a prejudice prevails against the method, it has not had such an extensive trial as it deserves; but, as the prejudice is not born of personal interest, it would doubtless be removed by a clearer knowledge of the system and its attendant results. By pulping turnips and mixing with cut straw a considerable saving can be effected; in short, the supply of roots can be reduced to one-half the ordinary quantity (or from 150 lbs. to 75 lbs.), along with cake or meals to a feeding bullock per day, with a similar reduction to young and growing animals. Such a saving is a great consideration, and pulping is surely a mode of preparing food worth giving an impartial and exhaustive trial. Some people have abandoned the system of pulping roots in despair, on account of their stock not making satisfactory progress upon the prepared food; but upon inquiring into the whole system of feeding pursued in such cases, it appears that the animals were not supplied with water, and as water is requisite when the allowance of turnips is brought to such a limit, it would be a matter of surprise if the results in such cases were entirely satisfactory, seeing that nearly two thirds of the weight of the animal's body is composed of water. When roots are dirty, as they frequently are, when lifted in the winter months, it is necessary to wash them before pulping, not only to save the machine from unnecessary tear and wear and to prevent its destruction by small stones, but to present the food to the stock in a clean and palatable form. During the last few years the labour and expenditure of the husbandman have not been rewarded by full crops of turnips, and extensive resort has necessarily been had to artificial food, and it is probably during such seasons, when farmers are compelled to use artificial food, that its advantages become most apparent. As we must drift with the stream as circumstances direct, probably the best thing would be to somewhat alter our stereotyped rotation, and put a smaller breadth under what in this district we may call the 'sorry crop,' and rely to a greater extent on extraneous assistance in the feeding of stock. I advocate the more extended use of artificial feeding stuffs for three reasons. First—Because, if you pay for them you are sure to get them, whereas you may be at the trouble and expense in endeavouring to produce a crop of roots, and have a partial, amounting at times to almost a total, failure of the crop. My second reason is that I consider by a moderate use of concentrated feeding stuffs, and a limited allowance of roots, flesh and fat can be laid on the bones of our animals in less time and at less cost than by the common system of allowing them all the turnips they can consume. My third reason for advising the use of such substances is, because I believe the fertility of our fields can be considerably increased by the extra quality of the farmyard manure, in which a judicious mixture of the richer varieties of food has entered into the dietary of our stock. And I also believe that this extra fertility can be purchased at a less cost indirectly by the use of such food amongst the stock than by directly applying to the crops the expensive ammoniacal and phosphatic manures. Of course, it has to be borne in mind that in order to obtain the full benefit from the consumption of artificial food no waste should be permitted in the courtyard, and in order effectually to prevent waste, the manure heap necessarily requires to be covered, and the wash of the byres, without being contaminated with rain water, should be carefully conducted to the heap, and there preserved so far as can be absorbed by the manure. In the most economical feeding of stock, a knowledge is required of the exact relationship that exists between an animal and its food, and of the analysis of the various kinds of food. An acquaintance with physiology, together with the researches of chemistry, have given the necessary information, and by these lights which illuminate the otherwise dark paths of agricultural knowledge, I shall briefly consider the constituents of food, and refer to their relationship in the animal economy. The various constituents of food are divided into two distinct classes, the nitrogenous and the non-nitrogenous. The nitrogenous portions of food are albumen, caseine, and fibrine, and are called flesh formers because they form the blood and tissue of the body. The flesh-formers are present to a limited extent in the straw of cereals, but mostly abound in the seeds of beans, pease, lentils, oats, and wheat, while the seeds of cotton and flax are particularly rich in them. The non-nitrogenous portions of food are of two principal kinds—the oils and the carbo-hydrates, or starch, sugar, pectin, and gum. In the animal economy these

maintain the heat, promote respiration, and form fat. In Indian corn, in the straw of cereals, and in the dry matter of potatoes, starch is present in large quantities. Sugar and pectin are common constituents of mangolds, carrots, turnips, and other roots. In the animal system, oil serves two purposes, *viz.*, for the maintenance of heat and for the storage of fat. For the purposes of respiration, oil has two and-a-half times as much value as the carbo-hydrates, because it contains that excess of carbon; and that portion of it which is digested goes for the storing up of fat in the system. Some of the leading physiologists have recently changed their views, and they now regard the carbo-hydrates as being useful in the animal economy only for the purposes of respiration and for the maintenance of heat. Formerly such substances were looked upon by all as being useful for the production of fat. However, it matters little; for were it not for the carbo-hydrates, the animal heat and force would necessarily require to be supplied by the albumenoids and oil present in the food. Science shows that the animal body is composed of the following four proximate elements:—1st, water; 2nd, albuminous tissues, represented in the food by nitrogenous matters or flesh-formers; 3rd, fatty tissues, being represented by hydro-carbons or fat-formers and heat-producers, 4th, saline, having its corresponding representative in salt. It therefore follows that, in order to maintain the animal system in health, it must be supplied with food containing all the constituents of its composition. Physiology has given well-defined principles, sufficient for the purpose of properly regulating the diet according to the intention of the feeder. Thus young and growing animals should be supplied with food best adapted for the building up the lean part of the body, or for giving them bone and muscle. For this purpose gluten or albuminous matters are absolutely necessary, and should occupy an important place in the composition of their food. The amount of flesh that can be derived from food depends upon the quantity of albuminous constituents present in the food. For the full development of muscle, animals should have plenty of exercise, and they should also have access to salt, which is necessary in the animal economy Feeding animals, on the other hand, should be supplied with food most conducive to the production of flesh and fat, and for that purpose the oleaginous food, or substances rich in fat and oil, should be mixed, in suitable proportions, with the albumenoids or flesh-formers—*i.e.*, albumen, caseine, and fibrine—and the carbo-hydrates for heat givers—*i.e.*,—starch, sugar, pectin, and gum. Having considered the various constituents of food, and their respective uses in the animal economy, I shall now briefly refer to the analysis of the common varieties of food produced on the farm. By analysis we find that turnips contain fully 90 per cent. of water; it consequently follows that there is scarcely 1lb. of dry feeding matter in every 10lbs. of them, and in that small quantity of dry matter there is no oil for the rapid accumulation of fat, and only 1¼lb. of albumenoids or flesh forming compounds; they contain, however, about 5½ lbs. of the carbo hydrates or non-nitrogenous constituents of food, the uses of which have just been explained. The cereals contain a much less proportion of water, but still the moisture present in oat straw in good condition is as much as 11 per cent of its entire weight. Every 100 lbs. of oat-straw contains ¼lb of oil, 1¼lb albumen, and 37 lbs of the carbo hydrates, and as a feeding substance it has a greater value than is generally accorded to it. The grain contains 4½lbs. of fatty matters, 9lbs. and 41lbs. respectively of the albumenoids and carbo-hydrates. The feeding properties of clover hay greatly depend upon the mixture of the various grasses and the amount of clover present in the mixture. Before the crop is at full maturity, or before the seeds begin to ripen, the nitrogen is most abundant, and as ripening proceeds, the nitrogen diminishes, while the proportion of the carbo hydrates increases. It will thus be seen that the analysis of hay must vary greatly according to the stage of maturity the crop has attained when cut, and the condition in which it is secured. Theoretically in the feeding of cattle, hay and turnips should produce results equal to a supply of good oat-straw and turnips, alone with several pounds of linseed cake. It has been estimated that, as an auxiliary to the ordinary food, 7lbs. of oats and 12lbs. of clover hay are equivalent in value, and should each make 1lb. of live increase. In the meantime, oats at 20s per qr of 320lbs. represents £7 per ton; and according to the above scale of comparative values, hay should be worth as an article of food about 82s. per ton, whereas it can be purchased in the market at about 60 per ton. The analyses which have been given clearly show that there is an enormous loss in the conversion of the natural produce of the farm into meat, and many theoretical men are astonished how cattle thrive and fatten as they do upon such food. But still, even those who pin their faith to chemistry and its teachings, if possessed of experience gained in the practical school of nature, will readily admit that the results are much better than can be expected, and especially is such the case when the natural food has been produced on good soil, and in high manurial condition The reason why such substances as straw, turnips, mangolds, and potatoes, which contain little but water and the carbo hydrates, fatten animals at all, is because, as has already been explained, the latter maintain heat in the animal system, and, by assimilation to a limited extent, they may be transformed into fatty matters, and therefore become stored as fat in the body. In these days when the turnip crop is a very uncertain one, and from its uncertainty the expenses connected with the production of beef are high, farmers cannot afford to lie in the arms of Morpheus, but must be ready to take advantage of all the benefits which flow from an increased knowledge of science, and the lessons which practical experience teach. Science teaches us that the food generally served to fattening animals is not of a nature capable of producing the best results in the least time, and it also shows us that if we are aiming to produce flesh and fat at the least cost, and in the least time, it is of paramount importance to have the food of the requisite nature for those purposes. Seeing that in the natural produce of the farm, oil is scarce, in artificial food it becomes the more necessary ingredient for the early maturing of stock, and it also becomes necessary so that the flesh of our animal be well mixed with fat. In linseed cake the proportion of moisture is only about 10 per cent, or one-tenth of its entire weight, the remaining nine tenths consisting of substances of more or less value as food, and contains from 10 to 12 per cent. of oil, about 28 per cent albumenoids, and from 30 to 36 per cent of the carbo-hydrates. Such analysis clearly shows that linseed cake is a very valuable feeding substance, and from its better digestibility it possesses a value above that of decorticated cotton cake, although the latter possesses on analysis 50 per cent higher than the former. The value of any food greatly depends upon its digestibility, and practical tests have shown that as a feeding substance, decorticated cotton cake is inferior to linseed cake. From the indigestible nature of decorticated cotton cake, eminent authorities have given it as their opinion that as much as seven eighths of its albuminous constituents pass through the animal without being assimilated. Decorticated cotton cake contains a half more nitrogen than linseed cake, or nitrogen equal to 8 per cent ammonia, consequently its manurial value is very great, and if that be taken into consideration, which it deserves to be when estimating its value, then it is worth considering whether it is not susceptible of improvement by grinding and mixing with other substances of a less concentrated nature, and thereby enhance its value as a feeding substance. The preparation of food is a matter of considerable importance in connection with the economical consumption of the turnip crop and the judicious feeding of cattle. The system of cutting straw and pulping roots, which a few advanced feeders have adopted, has much to recommend it, inasmuch as whatever meals are used can be readily mixed with the prepared food which is given in a more presentable form, and not attended by the waste which takes place under the ordinary system; the animals also can the sooner take their food and consequently have more time for rest. In the fattening of cattle generally in this district, I believe the practice of most farmers is to allow a bullock 130lbs. of roots per day, along with straw *ad libitum*. If such a quantity was given along with a very liberal allowance of concentrated feeding stuffs, cattle could scarcely be expected to pay for their fare. But if the supply be reduced to nearly one-half, or a quantity not exceeding 100lbs. per day, along with 4 or 5lbs. of cake or meals, there is a greater probability of a return for both, the natural and artificial food consumed. In many cases when very large quantities of highly concentrated food are given, I am afraid that a direct profit from its consumption would be too much to expect. It is desirable that whatever is given in the form of artificial food, should be given in good condition, and suitably balanced, containing the proper proportions of albumenoids, carbo-hydrates, and oil, so that the process of fattening should be as much hastened as possible. In the meantime, various substances, such as oats, barley, and linseed can be compounded by the farmer in proportions to show an analysis similar to linseed cake, and at less expense than cake; but as farmers generally mix their meals with cold water, a considerable amount of the nutriment is destroyed by that rough and ready process Meals should be always given dry, or mixed with boiling water, which would be the means of at least partially cooking the food and making it more palatable and more easily digested. In preparing a meal it is desirable to draw the constituents from a variety of sources, because the oats and barley ground into meal, being comparatively poor in albumenoids and oil, would never do to be given alone. In order to increase the feeding value of such substances, it is necessary to add nitrogenous constituents, which can be done by adding bruised linseed or decorticated cotton cake ground into meal. It is to be remembered that the nutritive value of a food does not depend altogether upon the nitrogenous elements or the supply of albuminous compounds present in the mixture, but to a certain extent upon its digestibility and palatability. In compounding a meal, care should be taken not to have too much oil present, as a superabundance would have an injurious effect upon the animal's digestion, and for a feeding bullock possibly 1lb. is as much as can be assimilated in the twenty four hours. As ruminating animals require a certain amount of bulk in their food, it would not do to feed them upon a highly concentrated food alone without a supply of the bulkier kinds, such as turnips and straw In reference to the comparative values of natural and artificial food, I may mention an experiment which was carefully conducted by Mr. John Milne, of Leathers, Turriff, and recorded in the last published volume of the *Transactions* of the Highland and Agricultural Society of Scotland. The result of the experiment clearly showed that 4lbs. of linseed cake and 5lbs of cotton cake or maize were equivalent to 10lbs. of turnips Seeing that by analysis cotton cake is 50 per cent better than linseed cake, a directly opposite result might have been expected. There are many other important matters connected with the feeding and fattening of cattle which claim attention; but, as I have already occupied too much of your time, I shall briefly allude to only a few of them. The most important of these I consider is regularity in feeding, which is the means of preventing restlessness, and is therefore of great consequence Cleanliness of the byres, and animals should be carefully attended to, and their litter should receive attention. A suitable and even temperature, together with properly ventilated buildings, and an immunity from draughts, are none the less desirable, yea, essential to satisfactory progress It is unnecessary to mention that in order to secure satisfactory results in fattening, judicious care and treatment are necessary from the day of the animal's birth to bring satisfactory results in £ s. d.
—*North British Agriculturist.*

EXPERIMENTS ON THE SULPHITE WOOD PULP PROCESSES

A CONTRIBUTOR to the *Papier Zeitung* publishes in the number of that journal for the 15th ultimo a communication of which the following is a translation .—

Last week we had a visit paid us by a gentleman who had been several days with Mr. Ekman at Bergvik, and with Mr. Francke at Molndal, Sweden, for the purpose of experimenting; and we are now able, owing to his friendly assistance, to state exactly the result of his visit.

We must in the first instance correct our previous statement with reference to Mr. Francke's boiler, so far that the taps are now different. The taps are not made as usual of cast-iron, but are merely a continuation of the cylindrical boiler with egg ends; indeed the boiler is merely tapered off at the ends, and is constructed without any sharp corners or angles, so that it can be thoroughly well lined with lead; the ends are closed by screwing on brass plates. At each end of the cylinder, just about where the tapering off into egg shape commences, two broad iron bands about 8 inches wide are placed, which latter are carried on two heavy cast-iron rollers 18 inches diameter; these four rollers are supported on cast-iron bearings, and the cylinder revolves slowly on these rollers driven by cogs.

The boiler fully lined with lead weighs quite 40 tons; the lead is not attached to the boiler in any way, but forms a boiler of itself inside the iron cylinder; on the inside of the cylinder at distances of about 8 feet apart are introduced brass rings of 1inch thickness by 2 inches wide in the shape of wedges which keep the lead against the outer iron shell.

Ekman's mill at Bergvik, near Soderham, 350 kilometres from Stockholm, only prepares unbleached stuff, which is worked up by Thompson and Bonar of Ilford, near London. The boilers used here are only 4½ feet diameter and 12 feet long, and are constructed like Lahousse's straw-boilers. Ekman's mills are worked exactly on the same principle as that described in his American Patent No. 21 of 1882.

On the other hand, while Francke and Mitscherlich use lime, Ekman uses magnesia, which he procures in the shape of carbonate of magnesia from Greece and Germany; this magnesia is burnt in the same manner as chalk, by which process it loses its carbonic acid, and is converted into magnesia; this is placed on shelves inside a leaden tower lined out with wood so as to protect the lead, and sulphurous acid gas is introduced passing upwards, water being allowed to trickle down over it, which is partly absorbed, so that at the end of the operation merely a slimy mass remains; the boiling with the solution of magnesia and SO2 is conducted as described.

We think it improbable that Ekman obtains his SO2 from Sicilian sulphur instead of from pyrites.

It seems of importance that Ekman does not cut his wood into pieces like Francke or other cellulose manufacturers, but that he first saws it into planks, and carefully bores out every knot afterwards; it is very easy to distinguish the imperfections in boards, whereas in the small hacked up pieces these are very difficult to detect. These boards are split up still smaller, and then crushed

We are indebted to this costly preparation of Ekman's stuff for the following results, viz., that his stuff works up quite clean, without using any knotters or strainers. Our informant brought samples of Ekman's and Francke's raw material, and samples of the stuff at all different stages of the process, and the result proved that Ekman's stuff boiled (not bleached) is cleaner and nearly as white as Francke's bleached stuff.

The paper made from Ekman's unbleached stuff, and which we we have seen, can be used for the best writings, and is superior to paper which was made from Francke's stuff which was only fit for news; we have also seen paper made from Ekman's bleached stuff which is quite equal to paper made from fine linen.

The principal theoretical difference between the lime and magnesia process is that the gypsum (lime process) is not easily dissolved, and remains in the stuff, whereas the sulphate of magnesia is readily dissolved, and is easily washed out, none of it remaining in the stuff.

We do not know whether the magnesia has any other advantages over the lime, but it would be very interesting if this could be proved by a trial. The cost of Ekman's unbleached stuff at Bergvik is £13 per ton, but the selling price is £20 per ton. It has been proved that, according to the price, Ekman's stuff is better than either Francke's or Mitscherlich's as it comes into the market, we are, however, unable to say whether this is owing to the method of manufacture or to experience.

The French paper manufacturers who visited Bergvik gave a detailed account in the French language, which we now repeat, translated and condensed.

" Result of experiments made at Bergvik in the presence of the undersigned manufacturers, on the 25th and 26th July, 1882. The wood, white pine, was felled in the spring of 1881, and sawn up in autumn into planks weighing 4,395 kilos :—

		kilos.
There was a loss during storage of planks of	...	260
Do. through cutting	...	233
Do. through cleaning, dusting and sorting	...	332
Making in all a total loss of	...	825

825 kilos from 4,395 kilos, leaves 3,573.

" This lot of 3,570 kilos was put into 4 boilers, and after being washed in the ordinary potchers, was put up into 18 bales weighing nett 2,875 kilos, (moist weight); on being dried this was reduced to 51·30 per cent dry stuff; another trial, or test in the same way only yielded 48 70 per cent—the last trial seems more correct. Taking the yield at 50 per cent, by splitting the difference, the weight of the dry stuff obtained in 1,437 kilos .·.—32·68 per cent of the raw wood which contained 21 per cent moisture.—Bergvik, 27th July, '82, signed by 12 gentlemen whose names we cannot decipher, and therefore omit."

The yield of 32·68 per cent boiled unbleached stuff seems *low*, but if we consider the 21 per cent moisture which it contained, the dry weight would come to more than 40 per cent, but even then the yield is smaller than Francke's or Mitscherlich's; when, however, we consider that the stuff is perfectly clean and free from dirt, impurities, and gypsum, the yield is not really so low in comparison

Mr. Kramer uses the Mitscherlich cellulose advantageously for printing and lower quality paper.

Mr. Kramer prefers the Mitscherlich cellulose to soda boiled, and says it is tougher; Mr. Pettermann, of Wangen, has compared several samples of paper made from Mitscherlich stuff, and is of the same opinion as Mr. Kramer.

Mr. Kramer washed some of the Mitscherlich stuff in a five-centner engine for two hours, after which he says it worked up very well; and Dr Dorn confirms what Mr. Kramer says and states that he washed some with muriatic acid three quarters of of an hour, by which operation the gypsum entirely disappeared, and this stuff then takes the colour very well for papers.

Paper made entirely from Mitscherlich stuff without the admixture of rag is not good, and calenders very badly (that is, a bad surface); Mr. Petermann holds that it is very advantageous to wash the cellulose with hypo sulphite of soda, which materially assist the sizing; Mr. Kutter would prefer that the Mitscherlich stuff were washed and free from gypsum.

Another article appears in the same journal of the 22nd ultimo on the subject of sulphite wood pulp and soda cellulose, as follows :—

A great deal has been written lately about sulphite wood pulp, but few figures have been brought forward by disinterested people. There is, however, in No. 8 of the *Papier Zeitung*, an interesting description of the sulphite wood manufactory at Korndal, near Gottenburg; and as the figures seem to be given by a disinterested authority, they may be assumed as correct. No doubt a comparison between these and those of the soda-boiled cellulose will prove interesting.

The boilers at Korndal are 7 feet diameter by 40 feet long, and cubical contents of each 1,500 cubic foot; the weight of sulphite stuff (dry) produced from a boiling is 1,800 kilos These figures do not agree with the patentee's, *viz.*, that the weight of the manufactured article is much larger than that of the soda treated article, for.—

Lee's boiler, 4 feet diameter and 10 feet long, contents 500 cubic feet, yields for each boiling 650 kilos. dry cellulose.·.—1,950 kilos for 1,500 cubic foot.

Sinclair's boiler, 600 cube foot, gives 800 kilos.·.—2,000 kilos for 1,000 cube feet space.

Spherical boilers give about the same result.

Now, one can quite well surmise that the the sulphite manufacturers fill their boilers as full as they conveniently can, and that in every boiler a cubic foot holds about the same quantity of wood: from this, it would appear that the sulphite process cannot give a greater yield than the soda process, and it seems, therefore, that this great saving does not exist; the high yield the patentees assumed owing to their basing the same as chemically free from water, whereas the soda manufacturers take their weight as it is produced in the process; and this largely assumed yield will be yet more difficult to understand when the result of M. Knosel's experiment proves that by washing and bleaching 23 per cent more weight is lost.

The number of boilings at Korndal in each boiler in 24 hours is 1½ to 2; but as with the soda process three to four boilings are accomplished in 24 hours, so one is enabled to boil double the amount of stuff in the same boiler in the same time; and as the boilers hypothetically contain the same cubical contents, thus for boiling with soda only half the number of boilers is necessary, therefore the cost for soda boilers will be lower, and they stand twice as much strain, as they require no costly lead lining and no expensive arrangements for revolving. The wear and tear in the sulphite process seems considerable, as the lead has to be renewed yearly although of 3 m.m. thickness, and this 5,000 kilos of heavy lining necessitates many other expenses for soldering and repairs.

With the soda process the boilers last for ever, as the soda ley preserves iron; and we have even several instances of boilers which were not tight at first becoming tight after use, as the leaky places become filled up in time with lime and silica incrustations.

Cost of Chemicals —I much regret that this point is not alluded to in the No. 8 *Papier Zeitung*, as it is of great importance. I will not repeat Mr Catcheside's figures from No. 4 *Papier Zeitung*, as other figures emanating from the inventors vary more than 100 per cent. (See notice in the *Papier Zeitung*, that an English mill which was to have cost £8,000 cost £14,000, and then only turned out two-thirds of the stated or promised production).

Mitscherlich gives the cost of chemicals at 32 marks per 1,000 kilos sulphite pulp; whether this is correct I do not know, although it has been proved that other calculations of Mitscherlich's have been too low, yet I will assume his figures to be correct; then from these figures it has been proved that the sulphite process has no advantages over the soda process, for if one recovers 92 per cent of the soda, the charges for 8 per cent of soda with lime, coal, and labour for the recovery would amount to 32 marks per 1,000 kilos of wood pulp, and there is

also the advantage of using the waste heat given off in the burning, but in the sulphite process this recoverable matter, which constitutes half the weight of the wood treated, is totally lost.

There is no account in No. 8 of the recovery by burning in the sulphite process, but in the soda this has been reduced to such a minimum that it can hardly be so little with the sulphite.

Manufacturers who know nothing of the sulphite process are trying it, but they will find out in the end that the soda process is the best.

This also holds good for Esparto grass; and the well-known authority in this matter, Mr Routledge, in alluding to a resumé of Knosel's views on the sulphite process, surmised that it promised more than could be realised.

Lee's and Sinclair's soda processes were also very promising, but we know how their results have been carried out, and it is only after ten years' experience and costly experiments that they have been accomplished.

In Sweden no one has followed Ekman's system, and on the other hand lately several soda cellulose manufactories have been erected.—S.—*Paper Maker's Monthly Journal.*

ARTIFICIAL MANURES.

As far back as 1879, a work on Artificial Manures appeared in this country, written by a French chemist, M. Georges Ville, and translated and edited by Mr. Crookes, F.R.S. Few works on agricultural matters have caused more interest. The writer gave his opinions with so much confidence—quoting experiments in proof of the conclusions he had arrived at—that the public were very much carried away, and disposed to take M. Ville at his own valuation. The work was favourably and largely noticed, and we think that the *Field*, amongst other papers, called attention to the remarkable results said to have been obtained by the use of artificials, and also to the statements as to the power of certain plants to obtain supplies of nitrogen direct from the atmosphere.

Quite recently Sir J. B. Lawes has published in the pages of the *Agricultural Gazette* a series of seven articles which will be found in the numbers from January 1st, 1883, in which he subjects M. Ville's statements to a critical examination, and exposes their utter unreliability. The farming public, who are interested in this question, are much beholden to Sir James B Lawes for having detected these fallacies, which as their principal object was to discredit farmyard manure and to exalt the virtues of artificials, and especially of certain receipts which appear at the end of the book, might, if accepted by English farmers, have led to great losses.

Artificial manures, suitable to the particular soils and crops, are valuable supplements to farmyard manure. But this, as containing all the materials required in plant food though perhaps not always in the exact proportions most necessary, and being made, as a rule, at much less cost than what we pay for artificials, should be for nine-tenths of us our main resource. Instead of our being led away by a will-o'-the-wisp in the form of patent manure, and so induced to continue the wretchedly wasteful methods of manufacture which still too frequently prevail, we should be told how we may improve our practice, and how, by making and keeping our manure under cover, we may secure a concentrated and portable material, which will, if we only have enough of it, render us to some extent independent of artificials The more we can replace the outlay now made in artificial manures, by outlay in feeding materials which enrich the droppings of animals eating them, the more profitable will be our operations, because we shall get back much of our outlay in the animals, and we shall have a much more permanent manure; for, as the reviewer points out

"If there is one fact more than another upon which all practical farmers in Great Britain are absolutely agreed, it is that of the lasting properties of farmyard dung as compared with artificial manures; and I may add that the general result of the Rothamstead experiments has not only been to confirm the experience of practice, but even to extend the operation of the dung to a far longer period, than that generally assigned to it."

This sentence was *apropos* of a statement to the effect that the idea that the farmyard manure in an experiment of a M. Ponsard had not been exhausted in one year, whereas the chemical manure had been exhausted, was "contrary to all the known facts." It may be as well to give the quotation from the preface to the French edition referring to this same experiment, as an illustration of the delightfully vague way in which matters, whose value depends upon exactness, are treated:

"M. Ponsard, President of the Agricultural Chamber of D'Ouroy, in Champagne, made two parallel experiments on a piece of waste land in one of the most barren districts of a proverbially barren portion of that province. He manured one-half of the ground with about 32 tons of farmyard manure per acre, and the other with about half-a-ton of chemical manure per acre. With the farm manure he obtained about 14 bushels of wheat, whereas with the chemical manure the land yielded about 36 bushels, there being a loss of £19 in the former case, and a gain of £17 in the latter."

If the figures as to profit indicate the general accuracy of the whole, we may pass over M. Ponsard's experiments as absolutely unreliable seeing that, whilst M. Ville tells us that the cost of growing wheat (which, under the present system of agriculture, is 5s 6d. a bushel) may be reduced to 3s. 9d., he yet would have us believe that thirty-six bushels of wheat realised a profit of £17 equal to 9s. a bushel; and this is, of course, supposing no value for the land, and no expense in its cultivation.

As regards the important question as to the sources of the nitrogen of plants, M. Ville's statements as to the power of plants to derive a portion of their supplies directly from the air is blown to the winds by a mass of facts, the result of actual experiments. M. Ville states that nitrogen is assimilated by plants in three different forms, *viz.*, as ammonia, as the nitrate of some base, and as nitrogen gas; and that it has been ascertained that "crops always contain more nitrogen than the manure supplied to them, and this excess is derived not from the soil, but from the air." Such a positive statement is proved by Sir J. B. Lawes to be absolutely erroneous in every instance. Wheat most nearly, of all our cultivated crops, accounts for the nitrogen supplied in manure. In every other instance where excess of nitrogen above that contained in the manure is said to be derived from the atmosphere, the very opposite is the fact—the manure contains more nitrogen than appears in the crop, and a considerable loss occurs. In the analysis of the soil in which his experiments were carried out, though *made with the greatest* care no mention is made of nitrogen, but he refers to it as similar to that of Rothamsted as to the nitrogenous matter. Sir J. B. Lawes states that within reach of agricultural crops, the arable soil contains from 10,000lb to 12,000lb of nitrogen per acre: but, apparently M Ville leaves this out of calculation altogether; and, because he finds more nitrogen in certain crops than was supplied in the manure, jumps to the conclusion that the balance was derived directly from the air. In the case of wheat—which, as has been shown, makes the best use of the nitrogen supplied—it is shown by the reviewer that 1cwt. nitrate of soda furnishes 17lb or 18lb of nitrogen, and that if every particle were taken up this would suffice for 11 bushels of extra wheat, and he thinks farmers would be satisfied with 6 bushels on an average; and that even in 1863, the year of maximum produce at Rothamsted, the amount of nitrogen in the increase of the experimental crop was considerably less than that supplied in the manure.

As regards beetroot, M. Ville's statement that there is an excess of 114½lb. per acre over that furnished by manure, which is derived from the atmosphere, appears to us wide of the mark; and this is actually proved from the experiments he quotes. Thus certain manures without nitrogen resulted in a yield of 14 tons 14cwt. of roots per acre. By adding to the minerals sufficient sulphate of ammonia to supply the respective amounts of 176lb, 220lb, and 264lb, of nitrogen per acre, a respective increase was obtained of 4 tons 6 cwt, 5 tons 14 cwt, and 9 tons 2 cwt. per acre. Now, as the highest increase could not have contained more than 72lb. of nitrogen per acre, and the smallest application of that substance was 176lb, it is evident that, instead of a gain, there is an enormous loss of nitrogen. Another most remarkable statement is that the *profit* on an application equal to 12 cwt. of sulphate of ammonia, which caused an increase of 9 tons 2 cwt. of beets, was £9 2s. 0d Numerous other gross blunders, inaccuracies, and contradictions are pointed out. Thus, in one place, we are told of experiments in which artificial manures proved more permanent, and in another lecture that farmyard dung, "owing to its nature and its bulk, necessarily acts very slowly . . . and becomes the equivalent of a large amount of acquired riches."

Perhaps the most amusing part of M. Ville's book—which must be really considered more in the light of a romance of agricultural science than a work dealing in facts—is that in which he criticises Boussingault's farming operations and balance sheets. Discovering a mare's nest as respects the value put on the manure, he makes out balance sheet No. 2, which, with the correction as to the value of the manure, turns Boussingault's modest profits at Bechelbronn, shown in his balance sheet, into a loss. Next by the use of certain artificial manures, crops are to be trebled, and the balance put on the right side to the tune of £525-11-2. Thus is developed balance sheet No. 3, and in a fourth balance sheet the profits are actually increased to £635 4-10.

Sir J B. Lawes points out many other errors which our limits will not allow us to recognise Enough has been advanced to act as a warning to our readers not to blindly follow the advice of one who, however well intentioned, is not a farmer, nor scientific man, but is evidently profoundly ignorant of agricultural practice. The season is coming on when artificial manures will be in use. They are, when composed of genuine ingredients, suitable to the crops and the soil, valuable as additions to the manurial resources of the farm; but, whilst we venture money in such aids, let us take care that we get as much as we possibly can from our home materials—*Field*.

IRRIGATION WORKS IN SPAIN.

The brochure by Sr. D. Andrés Llaurado, from which was translated the account given in a preceding number of the *Journal of Forestry*, on irrigation works in the south of France, was noticed in the *Journal of Forestry* at the time of its publication. It has subsequently been printed *in extenso* in the Spanish *Revista de Montes*, and it has thus again come under notice.

In a paper which was published in French in the *Annales des Ponts et Chaussées*, and which was subsequently reproduced in German, Bohemian, Italian, Portuguese, and English, and in Russ—the last-mentioned translation having by direction of the Government at St Petersburg appeared in all the official agricultural journals of the Empire—Sr L. had shown that extensive irrigation undertakings can only be executed with profit to the promoters and benefit to the general interests of the country when aid is given by the State, and when in addition to the direct returns anticipated by the Treasury, there is taken into account the direct returns brought to it by the thousand and one usual meshes from what may be called sedimentary wealth produced from a thousand transformations of the produce and works connected therewith. And in

view of the Government having announced the contemplated inauguration of a legislative company, organized for the development of the material interests of the country, and the Minister de Fomenti having intimated a welcome proposal to submit soon to the Cortes a draft bill likely to stimulate the execution of extensive works for the utilization in agriculture of water now running to waste, Sr. Llaurado deemed it opportune to bring under the consideration of the Minister in the first instance, and in befitting time under the ordeal of public discussion, some general estimates suggested by his friendly interest in the scheme, and sundry facts and important documents whereby he hoped might be supplied some aid in acquiring a correct knowledge of works already executed in connection with irrigation and sanitary and agricultural improvements,—and thus to supply evidence of the urgent necessity there is for doing what both the Government and public opinion admit that both the importance and the justice of the measure required should be done in the matter

Passing over, for convenience, details of arrangements of a legislative character, which had successively been required and made in the country, the author sought to stimulate the spirit of the projected association by giving details of what had been realized in connection with the greater work of canals and work of irrigation in France.

The author then states in regard to Spain :—" Neither the arrangements which were prescribed by Arts. 8, 11 and 12 of the Law of 20th February 1870, nor those modifying these which were prescribed by Arts. 195, 197, and 198 of the new Law of 13th June, 1879, have been able to do anything conducive to the realization of the purpose of the legislature, as without boldly facing the difficulties of the case, they only present ephemeral and inadequate provisions, establishing at the same time antagonism between interests which it should be the business of the State to reconcile '

The Government has estimated the imperial Aragad Canal has cost, and will yet cost, the Public Treasury—and although at first sight the balance drawn, presents many of the features of an enormous burden—it is impossible to avoid perceiving, when we proceed to analyse it a little, that the result satisfactorily repays with usury the great sacrifices imposed upon the State by the execution and maintenance of that work.

" A short time since, while the the Count of Tereno was Minister de Fomenti, there was submitted for the consideration of the Cortes a draft law relative to subventions to canals and reservoirs, in which the Art. 2 determined that the aid to be given by the State should be the third part of the estimated expense of the undertaking comprising the digging of principal and secondary aqueducts for the convenient distribution of the irrigation. The project was relegated to the keeper of the Archives, and abandoned in despite of the intelligent desire of the Minister being stated and supported by a reference to the umpires for its being thoroughly discussed, and we cannot at present secure for agriculture waters which are now running to waste in the basins of some of our rivers, while crops are manured and diminished, if not entirely lost, through protracted droughts."

Sr. Llaurado then gives the details of observations made by him in France, to which reference has been made, and goes on to say, in regard to what he considers practicable and desirable in Spain " What we should do is to combine with our own practice the French principle of giving aid to enterprises connected with agricultural improvements, including amongst these the construction of canals and reservoirs for irrigation, the improvement of moist and unhealthy grounds, the draining of marshes and stagnant water, and the submerging even of vineyards as a means of combating the plague of the phylloxera.

" In doing so the aid of the State, in accordance with conditions which we shall state immediately, should consist of terminable loans to be repaid by instalments along with the annual interest Guarantees of interest and capital invested in such undertakings, direct subventions in money, or it may be the entire construction at the expense of the State of works presenting exceptional difficulties. The advances within a fixed limit determined by law made from a special charter or credit established in the Ministry of Public Works, should bear, in the meantime, an interest of 3 per cent, and be repaid in a period of thirty years. A special regulation should determine the organization and practices of this fund, so as to avoid difficulties presented by a law of 17th July 1856, relating to draining, and modifying this in the new project, so as to make more accessible to agriculturists the benefits which this offers. To the associations or companies which with the authority of the Government may be organized with a view to the execution of works such as have been referred to, there might be conceded by the State, under conditions which will be stated presently, a guarantee of interest on the capital which they invest in the works. This guarantee of interest should be conceded through an order given by the Minister of Public Works, after consultation with the Council of State, confirmed by the Minister de Haciendo.

In the constitution of the Company should be embodied a stipulation to make a special contribution annually for the establishment of adequate amounts to be exclusively employed in payment of the interest and annual instalments towards the repayment in thirty years of the capital specified in the proposal approved by Government, which contribution must be altogether independent of what may be required to cover the expenses of administration and of the maintenance of the works

If, in the course of executing the works, as frequently occurs in works of this kind, it shall become manifestly the case that the sum sanctioned is inadequate, the State guarantee may be so extended to an excess, if justified, of not more than half of the amount first guaranteed This new loan, which the Syndicate may procure in excess of that at first granted, must in like manner be repaid within thirty years.

" In any case in which the contribution for meeting the expenses of the first establishment of the Company, and in which the other resources reckoned on by the Syndicate independent of those destined for the administration and use of the water and the maintenance of the works, may prove insufficient to carrry the normal interest and repayment of the authorised loans, the State may give to the friends of the Syndicate in the form of advances preferential terminal loans the amounts necessary to complete the annual provision for the aforementioned payments ; and these preferential loans granted by the State should bear a simple interest of 3 per cent.

" For security of repayment of these preferential loans together with that of interest on them all, the resources which are available for meeting the expenses of administration and maintenance, together with those for the first establishment of the Company, should be devoted entirely to the repayments of those advances made by the State, until the Syndicate obtain a full discharge.

"If the entire completion of the works require an outlay exceeding the maximum amount of the loans guaranteed under the conditions which have been stated, then, but then only, can the Syndicate obtain from the State a supplemental guarantee under an obligation to appropriate either through an increase of the normal contributions, or by some other means, sufficient funds to pay the interest and liquidation in thirty years of the new loan, and without prejudice to the provision made for the payments of the previous loans.

" If at the expiry of the time fixed by the order, a decree which conceded the guarantee of interest, the work be not entirely completed, the Minister of the department may order them to be completed at the charge and expense of the Company ; in which case the State shall reimburse itself the expense incurred by it in excess of the expenses specified in the original proposal limit and the Minister of Public Works, after hearing the Syndicate, fixing the corresponding increase of contribution to be made.

" With respect to companies, the Concessionarios of works, which we have suggested should be comprised in the law of State aid, we would establish the following basis :

" Concessionaries may obtain from the State a guarantee for the interest of the capital which they invest in the works. The guarantee shall be in force for fifty years, and should comprise interest and repayment of capital in that time—for which purpose there should be specified in the decree of concession the capital actually invested in the works in excess of subvention for work executed—and for legitimate expenses incurred by the Company obtaining the concession. The guarantee should in no circumstance exceed 4 65, inclusive of repayment of the capital invested.

"When the whole of the clear proceeds obtained through the execution of the works shall exceed 6 per cent of the capital actually invested in the works—after deduction of the whole gross amounts of the subventions of every kind granted—the excess, at what time soever it may occur, shall be appropriated to the repayment of capital and interest at 3 per cent of advances made under title of guarantee of interest. And whenever the State has been repaid its outlay, the excess shall be divided in equal parts between the public Treasury and the Concessionaries.

" A special regulation should determine all that relates to the guarantee of interest conceded by the State to the repayment of the advances which it may have made—to the partition of the benefits secured and to the form in which the Concessionaries shall meet with the intervention of the Government. 1. The burden of the expense of first establishment. 2. The annual expense of the maintenance of the works, and the exploitation of the enterprise 3 The dues and taxes. There must not be comprised in this annual expenditures for interest any repayments of the loans which the Concessionary may have obtained for the completion of the works—in case of the insufficiency of the capital guaranteed by the State. On the other hand, there must be included in these annual expenditures the interest of the security which the Concessionary had to give when such a deposit had to be made.

" The general question of the first establishment should be determined provisionally at the time at which the works are completed, and definitely five years thereafter, without which being done, in no cases can the Concessionary pretend to any augmentation of the maximum capital guaranteed by the State in the deed of concession. When the period of five years has expired, notwithstanding they may not have made any application, the Concessionary may be authorized by means of a decree, the information having previously been given to the Council of State, to add to this account all the expenses incurred in the execution of the works which have been acknowledged and declared as pertaining to the first establishment, it being understood that this augmentation can only have reference to the calculation made of the unforeseen excess of which mention has been made.

" We would likewise have it determined in the law of State-granted assistance, that the State would grant subventions to undertakings, and associations, giving themselves to the execution of works such as have been indicated, without prejudice to resources which may be appropriated to the same object by provinces and municipalities interested in the execution of the work. These subventions might be conceded by the State in the form of works of equivalent value executed directly by the public administration.

" If there be occasion for it, the declaration of public utility might embody in it authority for the execution by the State of the works spoken of in the supposed law. This authorization should in no case be carried into effect until those who are interested in the work have subscribed in due form a promise to organize a responsible Syndicate to secure the maintenance of the works so executed, and to make to the public treasury an annual payment sufficient to cover the interest and repayment of the portion of the expenses which would devolve upon them and the final completion of the project.

" The deed of declaration of public utility should fix the amount and duration of these annual payments and settle at the same time the proportion in which should be paid by the

Syndicate and by the State the annual dues till the completion of the time in which the whole amount advanced must be refunded.

"Finally, the State might concede pecuniary compensation to proprietors of marshy lands, which, under a declaration of insalubrity, in the terms prescribed by law, have completed works within a time prescribed in a legal injunction to proceed to the draining and healthful amelioration of those lands.

"Such, in conclusion, are the provisions which we consider the French Government should make in the new law which it is preparing for the settlement of this financial participation of the State in undertakings connected with agricultural improvements. But before closing our remaks it occurs to us to ask the Minister de Fomenti, in Spain—are such works connected with agriculture of less importance in our country than in that of an adjacent nation? Without fear of mistake we have no hesitation in believing them to be of much greater importance here, and though we admit that the Spanish treasury cannot undertake such sacrifices as may easily be borne by the French treasury, we firmly believe that it is evidently necessary that they should advance on like lines, slowly if you will, but without turning aside from the object or losing sight of the end which leads to the prosperity of our agricultural districts. Projects of the nature here treated of cannot be elaborated impromptu, or carried out without consideration, and in order to adapt them to the requirements and conditions of a country, they require the concurrence of much intelligence, with the aid of much action. If the Minister de Fomenti takes the work in hand, lending to the initiation of it his weight and influence, and if political changes do not prevent Sr. Alberada seeing from his ministerial department to the carrying out of the promotion by this means of the prosperity of our agricultural districts, he may rest assured that he will in all time coming possess a just title to the glory of the work initiated in these regions by the Government of which he is a member."

The treatise is dated 6th January, 1882.

JOHN C. BROWN.

Journal of Forestry.]

A NOTE ON SAP*.

By PROFESSOR ATTFIELD, F.R.S.

BENEATH a white birch tree growing in my garden, I noticed, yesterday evening, a very wet place on the gravel path, the water of which was obviously being fed by the cut extremity of a branch of the birch about an inch in diameter and some ten feet from the ground. I afterwards found that exactly fifteen days ago circumstances rendered necessary the removal of the portion of the branch which hung over the path, four or five feet being still left on the tree. The water or sap was dropping fast from the branch, at the rate of 16 large drops per minute, each drop twice or thrice the size of a "minim," and neither catkins nor leaves had yet expanded. I decided that some interest would attach to a determination both of the rate of flow of the fluid and of its chemical composition, especially at such a stage of the tree's life.

A bottle was at once suspended beneath the wound so as to catch the whole of the exuding sap. It caught nearly five fluid ounces between eight and nine o'clock. During the succeeding eleven hours of the night forty-four fluid ounces were collected, an average of four ounces per hour. From 8-15 to 9-15 this morning very nearly seven ounces were obtained. From 9-15 to 10-15 with bright sun-shine, eight ounces. From 10 15 until 8 15 this evening the hourly record kept by my son Harvey shows that the amount during that time has slowly diminished from 8 to a little below 7 ounces per hour. Apparently the flow is faster in sunshine than in shade, and by day than by night.

It would seem, therefore, that this slender tree, with a stem which at the ground is only 7 inches in diameter, having a height of 39 feet, and before it has any expanded leaves from whose united surfaces large amounts of water might evaporate, is able to draw from the ground about 4 litres, or seven-eighths of a gallon of fluid every twenty-four hours. That at all events was the amount flowing from this open tap in its water system. Even the topmost branches of the tree had not become, during the fifteen days, abnormally flaccid, so that, presumably, no drainage of fluid from the upper portion of the tree had been taking place. For a fortnight, therefore, the tree apparently had been drawing, pumping, sucking—I know not what word to use—nearly a gallon of fluid daily from the soil in the neighbourhood of its roots. This soil had only an ordinary degree of dampness. It was not wet, still less was there any actually fluid water to be seen. Indeed, usually all the adjacent soil is of a dry kind, for we are on the plateau of a hill 265 feet above the sea and the level of the local water reservoir into which our wells dip is about 80 feet below the surface My gardener tells me that the tree has been "bleeding" at about the same rate for fourteen of the fifteen days, the first day the branch becoming only somewhat damp. During the earlier part of that time we had frosts at night and sunshine, but with extremely cold winds during the days. At one time the exuding sap gave, I am told by two different observers, icicles a foot long. A much warmer, almost summer, temperature has prevailed during the past three days and nights. This morning the temperature of the sap as it escaped was constant at 52 F., while that of the surrounding air was varying considerably.

The collected sap was a clear, bright water-like fluid. After a pint had stood aside for twelve hours, there was the merest trace of a sediment at the bottom of the vessel. The microscope showed this to consist of parenchymatous cells, with here and there a group of the wheel-like or radiating cells which botanists, I think, term sphero-crystals. The sap was slightly heavier than water, in the proportion of 1,005 to 1,000. It had a faintly sweet taste and a very slight aromatic odour.

Chemical analysis showed that this sap consisted of 99 parts of pure water, with 1 part of dissolved solid matter Eleven-twelfths of the latter was sugar.

That the birch readily yields its sap when the wood is wounded is well known. Phillips, quoted by Sowerby, says :—

> "Even afflictive birch
> Cursed by unlettered youth, distils
> A limpid current from her wounded bark,
> Profuse of nursing sap."

And that birch sap contains sugar is known, the peasants of many countries, especially Russia, being well acquainted with the art of making birch wine by fermenting its saccharine juice.

But I find no hourly or daily record of the amount of sugar-bearing sap which can be drawn from the birch, or of any sap from any tree, before it has acquired its great digesting or rather developing and transpiring apparatus—its leaf system. And I do not know of any extended chemical analysis of sap either of the birch or other tree.

Besides sugar, which occurs in this sap to the extent of 616 grains, nearly an ounce and a half per gallon, there are present a mere trace of mucilage; no starch; no tannin; 3½ grains per gallon of ammonical salts yielding 10 per cent of nitrogen; 3 grains of albuminoid matter yielding 20 per cent of nitrogen; a distinct trace of nitrites; 7 4 grains of nitrates containing 17 per cent of nitrogen no chlorides, or the merest trace; no sulphates; no sodium salts; a little of potassium salts: much phosphate and organic salts of calcium; and some similar magnesian substances yield an ash when the sap is evaporated to dryness and the sugar and other organic matter burnt away, the amount of this residual mineral matter being exactly 50 grains per gallon. The sap contained no peroxide of hydrogen. It was faintly, if at all, acid. It held in solution a ferment capable of converting starch into sugar. Exposed to the air it soon swarmed with bacteria, its sugar being changed to alcohol.

A teaspoonful or two of, say, apple juice, and a table-spoonful of sugar put into a gallon of such rather hard well-water as we have in our chalky district, would very fairly represent this specimen of the sap of the silver birch. Indeed, in the phraseology of a water analyst, I may say that the sap itself has 25 degrees of total, permanent, hardness.

How long the tree would continue to yield such a flow of sap I cannot say. Probably until the store of sugar it manufactured last summer to feed its young buds this spring was exhausted Even within twenty four hours the sugar has slightly diminished in proportion in the fluid.

Whether or not this little note throws a single ray of light on the much debated question of the cause of the rise of sap in plants, I must leave to botanists to decide. I cannot hope that it does, for Julius Sachs, than whom no one appears to have more carefully considered the subject, says, at page 677 of the recently published English translation of his text-book of botany, that "although the movements of water in plants have been copiously investigated and discussed for nearly two hundred years, it is nevertheless still impossible to give a satisfactory and deductive account of the mode of operation of these movements in detail." As a chemist and physicist myself, knowing something about capillary attraction, exosmose, endosmose, atmospheric pressure and gravitation generally, and the movements caused by chemical attraction, I am afraid I must concur in the opinion that we do not yet know the real ultimate cause or causes of the rise of sap in plants.

* Read at a meeting of the Pharmaceutical Society.

INCUBATORS VS. HENS.

WHETHER there is more profit in artificial hatching than by the services of setting-hens is an unsettled point, for everything depends on the management in either case. That there are good, reliable incubators is a fact, but that "a child can manage them," as is claimed for some, is not established to the satisfaction of many adults who have engaged in such work. The advantages in favor of incubators are that chicks can be hatched at any season, the danger of vermin is lessened, and cleanliness is facilitated by the method. By early hatching, chicks come into market to sell at high prices and the pullets that may be kept over will lay in the fall and through the winter, The disadvantages are, the possibility of danger from oil lamps that are kept continually burning, and the liability of accident, or irregularity of heat, which may destroy all the eggs A slight accident to an incubator holding several hundred eggs, at a time when eggs are scarce, occasions a heavy loss, and one or two occurrences of such character rather weakens the faith of the operator. It is better, therefore, if large numbers of chicks are to be hatched, to use several small incubators, in preference to a single large one, for then an accident to one incubator will not occasion an entire loss. No matter how well they may be regulated experimenters will have to watch them carefully, as the weather, turning the eggs, and providing moisture call for regular and prompt attendance at certain periods. Some incubators are heated by gas, some by projections of the stove-pipe, and others by large quantities of hot water. Nearly all of them will hatch, by *prompt attention and management*, but that they bring forth ninety per cent, as claimed, cannot be depended on. After the

chicks are hatched they are reared in brooders, which are heated in several ways, generally with hot water, the heat being appreciated by the chicks when it is above them, as few survive when the heat comes from below.

In managing the hens, however, the nests should be placed in warm locations in winter and cool places in the summer. If the flock is large the hens will commence setting at different periods, and an advantage may be taken of hatching by using the following plan: Suppose, on the 1st day of April eggs are placed under a dozen hens, as all can be set at one time by keeping those that get broody before the others a few days, and suppose after the lapse of ten days, a second dozen are set; and we will further suppose the breeder to continue the practice by placing eggs under all the broody hens on the same day, when a sufficient number is ready. Now, we go back to our point: when the first dozen have finished hatching, give all the chicks to as few hens as can properly carry them, and take eggs that are under the second lot, and place them under the remaining number in the first lot. Then reset the second lot with fresh eggs. We can by that method keep each hen at work four and half weeks, and two hens will hatch three broods. We give the above as a supposition. It is entirely practicable, and also profitable, and with the same care and management as is required for incumbators will give much better results.

The hens and incubators may be managed together by placing eggs in the incubator every day or two, and when the chicks are hatched give them to the hen to be cared for. This will save valuable time on the part of hens, and will enable the breeders to raise a large proportion of chicks. We have no doubt that many of our breeders dread the care of the chicks more than the fear of bad hatches, but the hens will assist the incubator in that respect. —*New Southern Poultry Journal.*

CINCHONA.

CINCHONA: YARROW LEDGERS' ANALYSES.

WE learn that the last mail brought out the results of further analyses of Yarrow ledger bark from 5½-year-old trees by Dr. Paul of London, and we feel, sure our readers will agree with us that they are simply *splendid*, especially No. 5—*14·50* per cent of crystallised sulphate. The Superintendent of Yarrow has sent down 100 lb. of ledger bark from trees thinned out, and, as a test of what it will fetch in the local market, Messrs. Somerville & Co. have been instructed to sell it on Mr. Symons' *average* analyses of 3·7 per stem and 4 17 per branch bark. The result of sale will be duly reported. With Dr. Trimen's report and such encouraging results as we are now able to place before the public, there should be no hesitation about extending the cultivation of ledgers. The analyses are as follows:—

ANALYSES OF YARROW LEDGER BARK FROM 5½-YEAR-OLD TREES.

Number of Samples.	Crystallized Sulphate of Quinine.	Quinidine.	Cinchonidine.
1	12·30	Nil	Nil
2	7·94	,,	,,
3	11·82	,,	·93
4	11·90	,,	·75
5	14·50	,,	·20
6	12·50	,,	0
7	6·10	·33	·40
8	8·50	0	·75
9	10·40	0	0
10	11·40	·15	·10
Samples 10	107·36		

10·73 = average of 10 samples.

Analyzed March 1883.

CALISAYA VERDE AND MORADA.

WE are very glad to hear of the great success that has attended the introduction of this valuable seed into Ceylon from two such different altitudes as our two correspondents refer to, one being situated at 5,200 feet the other at a very much lower elevation, and we trust that the plants will continue to thrive and grow into large proportions. If they have the great robustness attributed to them, together with anything like the high percentage of quinine that ledgeriana has, they will indeed prove a mine of wealth to their fortunate owners. As Mr. Ffanshawe says, a tree that will thrive at a low elevation with a rich bark is the thing wanted, and *Verde* seems to supply that want. As regards its probable size in Ceylon it is impossible to draw inferences from what takes place in America. The whole of the Calisaya tribe grow to far larger proportions in their natural homes than they do with us, and the probability is that the same things will occur with *Verde* and *Morada.* Markham's reference to these varieties may not be uninteresting to our readers. He says:—

"Girond and Martinez told me that there were three kinds of Calisaya trees, namely, the *Calisaya fina* (*C. Calisaya, avera* Wedd.), the *Calisaya morada* (*C. Boliviana* Wedd.), and the tall *Calisaya verde.* They added that the latter was a very large tree without any red colour in the veins of the leaves, and generally growing far down the valleys, almost in the open plain.

"A tree of this variety and yields six or seven quintals of bark while the *Calisaya fina* only yields three or four quintals; and Gironda declared that he had seen one that had yielded ten quintals of *tabla* or trunk bark alone."

A quintal is more than a hundred pounds, so it will at once be seen that these trees grow to enormous proportions in South America and we cannot possibly expect such results here. If they grow to twice the size of ledgers at the same age, and thrive as they apparently do equally well at 5,200 ft. as at very low elevations, they will unquestionably prove themselves by far the most valuable of all the varieties of cinchona.—*Times of Ceylon.*

ATTEMPTED MONOPOLY OF LEDGERIANA BY THE DUTCH.

THE Dutch, as everybody knows, claim the credit of having been the first to introduce and acclimatise in the East the variety of cinchona now known as *Ledgeriana*, the bark of which is believed to be richer in quinine than that of any other. Seeds obtained from Bolivia were carried to Java, and planted in the Government gardens there under the care of Mr. Van Gorkom. After the plants had been thoroughly established there, seeds and cuttings obtained from them were not only distributed amongst planters in Java, but also, with the courtesy usual amongst botanists, they were sent to the Superintendents of Botanical Gardens in India, Ceylon, Jamaica, and other tropical colonies, as well as to the Royal Gardens at Kew, and the result has been, as our columns have testified, that this valuable species has been successfully established in almost all British possessions where cinchona is growing, and in Ceylon, at any rate, there is no difficulty in obtaining an ample supply of "Ledger" seed, locally raised, as the following from one of the latest papers to hand sufficiently proves:—

A planter declares his preference for seeds taken from selected trees in the neighbourhood, some of which are nearly six years old, and explained it thus: "There appears to be a general belief that ledger plants raised from seed cannot be relied upon to come up true to type; however true this may be in regard to imported seed, our experience certainly is, that with seed carefully harvested from selected trees of the true ledger type, the plants may be relied upon to come up true to type."

Moreover, Messrs. T. Christy and Co. recently received from their agent in Bolivia a consignment of ledgeriana seed taken from the same district where Mr. Ledger obtained his original supply, and these are in course of distribution throughout the East and West Indies. Under these circumstances, the policy enunciated in the subjoined paragraph from the *Batavia Dagblad* is not only churlish, but it is utterly futile, and amounts, in fact, to "shutting the stable door after the steed has been stolen"; but, at the same time, the action in question is eminently characteristic of the Dutch Colonial Government with its old-fashioned tendency to monopolies. Our Java contemporary says:—

"The scheme of selling by auction Ledgeriana cinchona seeds at the Government plantations here to British India planters, for whom they have more value than for those in Netherlands India, taking into account the fact that this variety of cinchona, the best existing, is most common here but is very rarely met with in British India, has justifiably drawn forth protests against it from all quarters. The scheme is objectionable in the interest of both the Government and the Java cinchona planters. By carrying it out, the Government would be killing the goose which laid golden eggs. Every catty of these seeds distributed throughout Java represents a future cinchona plantation, yielding a permanent revenue, direct and indirect, to Government. Every catty of them forwarded to British India yields only a handful of coin. Scandalous misuse of the liberality of Government by a few of

the planters here, who sold in foreign countries the seeds supplied them gratis for extending their plantations, has, in addition to the needs of the Treasury, caused the Government to hesitate on the good road hitherto followed. It strikes us that to prevent misuse of liberality, nothing would be more effectual than to give away seeds only on condition that if the latter cannot be accounted for by a certain number of seedlings in each nursery on a liberal percentage, the applicant will have to pay a high price for seeds not thus accounted for. So long as private estates do not yield seeds, and are neither extensive nor far apart, such control is not impracticable. We have since heard with pleasure that the scheme for selling cinchona seeds by auction has been postponed for the present."—*Planters' Gazette.*

CACAO.

COCA.

THE medicinal properties of this remarkable plant have lately attracted considerable attention. Its well-known property of stimulating the action of the heart and digestive organs has recently been turned to account in the United States in the treatment of dipsomania, and of the habit of opium eating, laudanum drinking, or sub-cutaneous injection of morphia. There seems no reason, also, why it should not be used to cure the habit of taking chloral. In all these cases it is a stimulant action which is required, and this coca possesses, while it does not produce any deleterious after-effects. Some remarkable results have been obtained by its use, more especially in cases of indigestion, which are entirely cured by this drug, and which lead to the hope that the leaves may soon be in extensive demand. A few cases illustrating these results we quote from a pamphlet recently issued by Messrs. Christy and Co., of 155, Fenchurch-street, who are the importers of the coca. These are genuine cases, taken from various medical journals of good repute, and not mere advertisements :—

" *Coca in dipsomania.*—I have employed this drug as a tonic stimulant in conditions of exhaustion, regardless of the cause. In a case of exhaustion associated with consumption, its effects are very pleasant; it prolonged life, and made it more tolerable. But it is in the alcohol habit that I noticed most remarkedly its benefits. It is an invaluable aid to the unfortunate who honestly desires to refrain, but who has not sufficient strength in himself to do so. There are cases in which the entreaties of wife and children, superadded to the exhortations of the physician, are of no avail in strengthening resolution. It is in these that coca is most effectual, It is *par excellence* the remedy in dipsomania.—E. A. ANDERSON, M.D., Wilmington, N.C."

" *Coca in opium habit.*—An unmarried man, æt. 27, contracted the opium habit five years previous to using the coca. Had become a great slave to morphine. June 1879, I put him upon coca. He ordered three pounds at the beginning. In October following I met him, and he assured me that he was entirely relieved of the habit and had one pound of his medicine left.

" One word as to my mode of using the coca. As stated above, it is capable of stimulating to any given extent. Now my plan has been to begin with a drachm dose of the fluid extract, *just* when the desire for the opium or whisky is quite urgent, giving it in a little water. If this does not produce sufficient stimulus to take the place of the accustomed drug, I repeat in thirty minutes, and so on. In this way I soon find the required dose.—W. H. BENTLEY, M.D., LL.D., Valley Oak, Ky."

" Allow me to call your attention to the fluid extract of coca leaves as a painless antidote to the opium habit. I have been a victim of it for twenty-three years, and was always on the look-out for an antidote. Finally, my attention was called to the above extract by W. J. Chenoweth, M.D., of this city. I commenced taking fluid extract coca; I kept myself under its influence for about two weeks, at the end of which time I found I could not take the smallest dose without it making me sick, and to my astonishment found myself entirely cured. My only object in writing this letter is to call the attention of the profession to it as a painless antidote.—Geo. Leforger, M.D., Decatur, Ill."

"M.T.P. had for several years taken large doses of laudanum several times a day for what he called 'disease of the stomach.' Was always complaining, and was low-spirited, sallow, poor, and a dejected lifeless-looking creature generally. He often took as much as a pint of the tincture of opium per week, and suffered intensely when without it even for a short time. As he said, his disease returned as soon as the laudanum gave out. I told him I at last had found a cure for his 'stomach disease,' and ordered the coca to be taken in drachm doses as often as he felt the disease returning, or whenever he felt that he could longer do without the laudanum. He used it frequently for two or three days, but gradually lessened the dose and frequency until cured. Since his cure he has rapidly improved in health and strength, both mental and physical; in short, he is a new man.—DR. P. R. HENDERSON, in *Louisville Medical News.*"

" A lady who had taken xvi grs. of morphia per diem, relinquished the habit, but within two days suffered intensely from insomnia, restlessness, vomiting, and prostration. After the second table-spoonful dose of fl. ext. coca, the pulse fell from 115 to 85, and all her symptoms were marvellously improved. On the following day she ate, digested, and felt well. The coca being continued in smaller doses, within a short time she was entirely cured.—*St. Louis Clin. Record*, Oct. 1880."

Mr. X. Y. had been addicted to the habit of taking sulphate of morphia for about five years, commencing with one-eighth of a grain for lumbago, changing it from internal to external application (hypodermically over the lumbar region), and gradually increasing the quantity until he reached the enormous dose of twenty-five grains as a maximum, three to four times a-day. . . . . I started him with the allowance of three twenty-grain doses of morphine, to be taken with a drachm of coca. In a week his morphine allowance had decreased to ten grains a-day, and his dose of coca increased to one-half ounce, and now, three weeks after commencing this treatment, the morphine has been entirely suspended.—H. F. STIMMEL, M.D., Chattanooga, Tenn."

The only obstacle that seems to stands in the way of the extensive use of coca, appears to be the difficulty of obtaining the leaves in the fresh state, since, unless very carefully dried, they lose their properties in six or eight months. Those who grow coca will therefore find it advantageous to employ some method of preparing an extract, or tincture, or beverage of the leaves from the fresh plant, as preparations so made will keep the properties of the plant unaltered for a very considerable length of time. When the leaves are exported they should be picked as soon as fully developed, dried carefully and packed in hermetically-sealed tins; dryness and exclusion of air during the voyage being absolutely necessary.

FORESTRY.

TRAINING FOR THE FOREST SERVICE IN PRUSSIA.

ONE of the first utterances of the *Journal of Forestry* was in advocacy of the organization of a School of Forestry in Britain. Six years have passed; but this has not yet been effected. The subject has, however, been formally brought under the consideration of the Corporation of London by the Superintendent of Epping Forest, and before the India Council by the Society of Arts; it has engaged the attention of the Principal of the Royal Agricultural College of Cirencester; and it has, for upwards of five years engaged the attention of the Council of the Arboricultural Society of Scotland. Of the membership of this Society, numbering well nigh 800, the great majority appear to be foresters and assistant foresters; of seventy candidates admitted to membership at the last general meeting, fifty were assistant foresters; and many of the members of the English Arboricultural Society are practical woodkeepers. With the interest thus manifested in forest management, some information in regard to the course of training followed by foresters in Prussia may be acceptable.

The following details of the requirements for employment and promotion in the forest service in Prussia, are given in the *Bestimmungen uber ausbildung und Prufung fur den Prussichen Staatsförst verwal tungsdienst* (Requirements for the Education and Examination of Officials in the Prussian State Forest Service).

No one can be received into the Forest Service if he does not satisfy the following conditions :—

1. " He must have obtained a diploma of completed study in a gymnasium of the German Empire, or in a *realschule*. 2. Be not above twenty-two years of age. 3. Have no bodily infirmity which would unfit him for the forest service. 4. Be of good conduct. 5. Give proof of possessing sufficient means to meet the expense of preparation for the work.

" This preparation commences with practical work done in the forest under the direction of an *Oberförster* during at least seven months generally from October to April.

"The design of these preliminary exercises is to make the aspirant acquainted with work of exploitation, and, with the principal kind of trees, to make him practically acquainted with sylviculture, with the surveillance of woods, and the police of the chase, and at the same time with land-surveying, all of which are things which lie at the foundation of his subsequent theoretical studies.

"To be appointed a *forst be flissener*, or forest-aspirant, an application must be made to the *Forst-Meister*, or to the conservator of the administrative circuit; this application must be transmitted by the *Oberförster*, to whom the pupil desires to be attached.

"The papers to be supplied are five in number.—1. The diploma of study from a gymnasium or *realschule* of the first class. 2. Certificate of birth or baptism. 3. A medical certificate. 4. If the aspirant do not pass directly from the gymnasium to the service, a certificate of good conduct from the time of his leaving the gymnasium. 5. An engagement by the father or guardian of the aspirant to provide for the maintenance of him during at least seven years.

"Further the *oberföster* must supply special information in regard to the family and person of the aspirant: and if there be nothing to hinder the aspirant being accepted, he receives his appointment from the inspector or the conservator. These have a reserved right to appoint the aspirant to another *oberförster* than the one he has chosen, and even to remove him during the time of his preparation, after having referred the matter to the Minister of Agriculture, Domains, and Forests.

"If the aspirant on trial prove not quite satisfactory in the triple point of view—physical, intellectual, and moral, the *oberförster* addresses a report to the *Förat-Meister*, and to the conservator, who judge whether the aspirant should continue his studies: in case of a difference of opinion between them, the minister decides.

"This stage passed, the *oberförster* delivers to the candidate a certificate testifying to the time spent in this stage, and to the work done. This certificate confers on the aspirant the title of *Förat-elsve*. To continue his studies, the forest pupil should follow for at least two years and-a-half the course of study of a school of forestry, or of a forest institute annexed to a university; those who may desire to follow that pursued in another school than those of Eberswald and Munden, should previously assure themselves from the office of the minister that the time spent by them at this school shall be reckoned equivalent to the studies prescribed by the regulations; and further, they are required to study all the subjects comprised in the programmes of these said schools.

"These forestal studies completed, and, at latest within six years after the commencement of the preparation, the pupil addresses to the minister an application to be admitted to the examinations, and attaches to this the following papers: 1. A *curriculum vitæ*, or history of his previous course of life, entirely in his own handwriting. 2. The diploma of study in a gymnasium or *realschule*. 3. The certificate of being a forest pupil; 4. The certificate of his having attended the course of study in a school of forestry or in a university. 5. A certificate that the pupil has taken the required part in works of land surveying and the preparation of charts at the schools of forestry, or at the university. 6. A chart prepared by the hand of the candidate of some royal forest of at least 500 hectares, on the scale of $\frac{1}{25,000}$ and this chart requires to be accompanied with an attestation that the work has been done entirely by the pupil.

"The design of the examination is to make it be seen that the pupil possesses the general instruction required, and that he has made with success the technical studies prescribed; and to determine further that the pupil is fit to continue his studies.

"The knowledge required at this examination is—

"*A*. Special science.

"Exploitation, management, estimation of woods technology, protection of state forests, and forestal history and bibliography.

"*B*.—Auxiliary sciences.

"1. Mathematics: Elementary principles of statics and mathematics.

"2. Natural History: principles of the classification of animals, plants, and minerals. *A*. Zoology: divisions of the animal kingdom mammalia, birds, and insects, looked at from a forestal point of view; entomological nomenclature, structure and habits of insects in general, and special study of those which are useless or hurtful to forests. *B*. Botany: classification, description, physiology, and structure of plants, and special knowlege of those which are useful from a forestal point of view. *C*. Mineralogy: general notions of geognosy and geology; general idea of the formation and the upheaval of mountains; influence of the subsoil on vegetation, and special study of the minerals and rocks useful to the forester. *D*. Physics and chemistry: general properties of bodies; notions in regard to light, heat, magnetism and electricity; carbonization, resin, and tannin.

"3. Legislation and jurisprudence: history of Prussian law; notions of civil and penal law as applied to forests.

"The examination takes place in general once a year, in September or October, before a commission appointed by the Minister of Agriculture, Domains, and Forests. This examination is held, one part in doors and another part in the forests; if it prove satisfactory, the forest pupil receives the title of *Först Candidat*.

"In case of failure he is allowed to re-commence his trials, in whole or in part.

"To continue his preparation, the forest-candidate should devote himself to personal studies in the forest, and, moreover, take an active part in all forests works, in order that he may acquire under an *oberförster* all practical knowledge relating to forest economy, and forest administration. In the first instance, he is free to choose the circuit in which he wishes to prosecute his studies; but the minister reserves the right to send him officially to any specified circuit.

"The *oberförster* near to whom the forest-candidate is sent is his immediate superior; and the candidate should take for his guidance in his service the instructions issued to forest overseers. The duration of the stage imposed on a forest-candidate is at least two years. He should pass eight successive months, which should always comprise the interval between December and April, in discharging the duties of a forest-guard in the same circuit, and in a particular part of the circuit. This part is chosen by the *oberförster* according to indications made by the inspector, and the candidate should give himself entirely to all the works of the guards, engaging in the surveillance, as well as in the exploitations, estimates, measurement of trees, sales, and the cultural operations going on.

"During these eight months he cannot be employed in the office of the *oberförster*.

"Then the candidate ought to visit different circuits: the design of these visits being to make him familiarly acquainted with all the kinds of trees growing in the forest, to give him explicit conceptions of different modes of exploitation and management; in fine, to give him practice in all kinds of forest business by making him take part in all the operations of an *oberförster*.

"During this stage, the candidate is required to keep a journal. This journal ought to indicate the circuits in which he has had a charge, their situation, their soil, and the exploitations and works of culture in which he has had to take part, &c.

"It ought, moreover, to contain notices of remarkable facts which have struck the candidate, and the observations which have been suggested to him by the study of the forest, and by the works which he has had to do in the office of the *oberförster*.

"The journal should be sent to the *oberförster* on the first of every month, and submitted to the superior agent present in the circuit, if such there be.

"In fine, when the candidate leaves the circuit, the *oberförster* should indicate the date of his departure, and give testimonials of his conduct; if there be occasion for observations in regard to faults of want of punctuality and obedience on the part of the candidate, or especially if he have shown a real incapacity for the work of the forest service, he is bound to make his report of it to the *Först Meister* inspector, and to the conservator.

"The Minister of Agriculture and Forests can exclude from the service every forest candidate who may have manifested notorious misconduct or negligence, or any candidate whose progress may be considered unsatisfactory.

"Every *oberförster* ought to send to the inspector, at latest on the 5th January in each year, a statement of the opinion of the candidates who have passed in the course of the preceding year more than four weeks in his circuit. The inspector adds to this his own observations. When the candidate has discharged the duties of an overseer, the inspector should give the result of the examination which he has made of the district entrusted to the management of the candidate; those documents are sent by him to the General Directory before the 15th January; they are collated and compared with those furnished by the conservator, and are then sent to the Minister to form the file of papers relating to the candidate.

"When the candidate has completed his course, done all the prescribed works, and satisfied the requirements of the military service, he may address to the minister an application to be allowed to pass the State examination: the time granted for this is five years from the passing of the last examination.

"To this application are attached the following papers:—1. A *curriculum vitæ*. 2. The diploma of study at a gymnasium. 3. The diploma of Forest pupil. 4. The certificate of diligence in the course of a school of forestry. 5. The journal. 6. Lastly, for candidates who belong neither to the corps of *feldjäger*, nor to the battalions of chasseurs, a document attesting that they have satisfied the military service.

"When there is nothing to hinder the authorization being given, the candidate is sent before a commission, who inscribe it, and fix for him the date of his examination.

"This examination is conducted according to the instructions and regulations of the minister, partly indoors and partly in the forests. The latter is by far the more important; it determines whether the candidate has acquired practice and knowledge of administrative questions.

"The examination turns on all parts of forest science and of forest economy in their connection, on the application of special law and common law to forest letters, and on the police and administration of the chase.

"The candidate having been subjected to this examination once, receives from the commission the title of '*candidat-oberförster*,' and is inscribed on the roll of officials going through their course of training.

"If the candidate do not pass the examination with success, the commission decides if he shall recommence his trials in whole or in part after a delay which cannot exceed six months.

The *candidat-oberförster* is employed in the royal administration so far as this is practicable until he receives his appointment, and he is bound to apply himself to the forest works which the minister may entrust to him.

"If the *candidat-oberförster* undertake the administration of communal forests, of public establishments, or even of private persons, he ought to communicate this to the minister; and this undertaking is not in any way a reason for excluding him from the Royal service; but it is clear that the years spent thus are not reckoned to him as years spent in service.

"And in case a candidate, after a certain lapse of time passed thus beyond the Royal service, should refuse a work which the administration would give to him, he may, on the proposition of the

minister, be removed from the roll of officials going through their course of training.

"Each *candidat-oberförster* is bound to make known, through the *oberförster*, his presence to the inspector, and to the conservator of the circuit in which he finds himself, that whether he belongs to the Royal service, or that he be administering private forests. Likewise, on each change of residence he should make a similar communication to the same agents.

"In order to acquire a more extended instruction, and perfect himself in the general practice of business, aspirants to the forest services hould, beyond their technical studies, go through a course of law and of political economy at a university. The candidate is free to make choice as to the time at which to pursue these studies, and that which may best suit him while prosecuting his preparation. But it is preferable that he should take them up while he is a *candidat-oberförster*.

"The *candidate-oberförster* who, besides the ordinary prescribed forest studies, give themselves for at least two half-year sessions to the study of these political sciences, can, after having been attached for one year to a directory of finance, address to the minister an application for permission to submit to an examination on the matters spoken of; which application should be accompanied by a certificate of his having followed a course at a university. This examination is conducted before the superior commission of forests, by the Minister-adjunct to the special examiners for legislation and political sciences. It turns on the application of civil law in Prussia to the administration of forests, and principally on the administration of law and political economy.

"The trials ought to show if the candidate possess the knowledge necessary to enable him to discharge in a satisfactory manner the functions of a *member of a forest directory*. The *candidats-oberförster* who pass this trial successfully receive from the minister the title of *forst-assessor*. The inspectors of *forst-meisters* are chosen from among the *oberförsters* who have most distinguished themselves in their service, and preferentially from amongst those who have passed the last mentioned examination.

A translation of these extracts appears in the *Revue des Eaux et Forêts* for last month, which indicates somewhat the importance which is attached to them.

JOHN C. BROWN.

—*Journal of Forestry.*]

SERICULTURE.

THE prime reason, says the *American Entomologist*, why the mulberry silkworm must ever be the silk producer of commerce, aside from the superior quality and quantity of its silk, is, that it is a domesticated insect, and that the worm can be fed in large quantities in partial confinement and under control; further, that while enduring the artificial life it shows no disposition to escape from the shallow trays upon which it is fed. All the other worms suffer more or less when brought together in large numbers, or when confined or sheltered, and in this fact, more than in any difficulty in using the silk, lies the secret of the failure to substitute any of them for *mori*.

SILK INDUSTRY IN KASHMIR.

SERICULTURE is not a new speculation among the Cashmerees. It is known to them from very early period. It is said, that a Chinese princess first introduced the silk in Cashmere by secretly putting some eggs of *Bombyx Mori* under her hair look when she was leaving her father's roof for her husband in Cashmere, as then there was a great restriction and heavy penalty for taking out the silk eggs off the walls of China, and thus she introduced it in Cashmere, her husband's kingdom. Since then it has been a very favorite industry among the Cashmerees who were rearing and spinning the silk in a juvenile rude system which is generally known under the name of "home spun." Filature was not known to them until Baboo Nilamvar Mukherjee, the renovator of the silk industry in Cashmere, introduced the system of high culture and machine reel, and succeeded in harvesting the crop of cocoons yielding silk and floss of value not less the £15,000 annually. But in the course of few years it showed its tendency to fall, and bye and-by it suffered so heavily, that a grain of eggs was not left. This sad failure was due to some unexpected natural phenomena to which the truth of Cashmere famine lies. A plague spreaded among man and beast, the worms were not excepted, and thus ended the golden era of the silk industry in Cashmere.

His Highness the Maharaja not liking to allow this fine industry to disappear from his territory, caused the silk worms of France, Italy, Bokhara and Japan to be acclimatized, and accordingly M. Ermens, the Superintendent of his vinery and distillery, was instructed to import some eggs of silk worms from France and Italy. The consignment reached us in the April of 1880, but they all proved a total failure. The next year Mr. Henvey, then the officer on special duty, Srinuggur, kindly undertook to import some eggs from Japan. The eggs reached Srinuggur in cards very sound and healthy, and yielded a crop of cocoons in the proportion of ½ oz. of eggs to 2 lbs. of cocoons all the cocoons thus obtained were breeded, and eggs were kept for the next season.

This is the origin of the second era of our Cashmere sericulture. From this little beginning we now expect to harvest a considerable crop of cocoons, aggregating the value of £9,000 in round numbers, and by this change of eggs we have succeeded in renewing and imparting a healthy and fresh impulse to our long-cherished industry of Cashmere.

S.

Jummoo, May 20, 1883.

NOTE.—The above note on silk is written by a native gentleman, whose English we have deemed it best to leave untouched.—ED., *I. A.*

TEA.

THE TEA TRADE AND EASTERN BANKS.

IT is, we learn, widely feared in the city of London that Eastern Banks have sustained irrecoverable losses by the tea trade of China. That trade is being ruined by the rival that it finds in India, yet each season finds the British, Australian, American, German, and Russian merchants at the treaty ports as intent as ever on competing against one another, and still prepared to pay "that heathen Chinee" prices far beyond the range of quotations current in Europe. The Chinese have a faculty for combining against the foreigners, and as they have not yet experienced difficulty in obtaining old prices for the tea that they bring to market, they do not allow their minds to be exercised by the more or less vague stories about Indian tea that reach them. Their customers at the ports are none too ready to credit all that they are told, or read, about the tea trade of India. They cannot yet bring their minds to believe that the day may not be distant when India will be the death of the tea trade of China. They hope on, season after season, that there will be a change for the better in the home market, and that a bumper year will more than compensate them for the heavy losses of several years. They remember that years of scanty profits have in former days been followed by years of grand returns; and they cheer themselves with the belief that the history of the tea market will repeat itself. And probably it would do so if China continued to possess the monopoly of the world's tea trade. Unfortunately for her tea growers and tea merchants, but fortunately for the world, she does not now retain more than about two-thirds of the world's custom. India has, in a dozen years, carried off the other third, and year by year will she obtain a larger slice of the trade. It may be that at the eleventh hour the tea shippers in China will be constrained to offer a united and irresistible opposition to high prices and low qualities, and thus succeed in competing on somewhat equal terms with India. But as yet prices rule obstinately high in China, and qualities get worse and worse. Indeed, were it not for the ready ability of Indian tea to blend with and raise the character of China tea, much of the latter would go out of consumption of Europe, the United States, and Australia. The Indian teas are now very largely, yet still unconsciously, consumed by the tea-drinking world. The ordinary house-keeper has no idea that tea is grown anywhere else than in China, and the Indian product does "good by stealth," by importing a much needed flavour to the abundant shipments of China tea of low quality. But the palate of the tea-drinker is being educated to like the characteristic taste of Indian tea, and dealers find it increasingly difficult to palm off tasteless China stuff. In short, the "one-eyed barbarian" of the far West is acquiring a capricious palate, and the Chinese must either contrive to sell good and relatively cheap tea, or retire from competition with India and the Indians.

Meanwhile, the tea trade of China is falling more and more into the hands of men of straw supported by local banks. The old firm whose

names are names to conjure with in Mincing-lane, have, to a great extent, drawn aloof from any other than a safe commission trade, and left the field to plungers and speculators, who are believed to be, in very many cases, inextricably in the books of Banks on the wrong side of the account. The latter continue to draw up to the hilt against bills of lading, and the banks, to keep them going, negotiate their drafts hoping that sooner or later the market will recover, and that losses may be recouped. And the Chinese themselves lend a helping hand to shaky firms, which assist in keeping up prices at the opening of the tea season. Thus it happens that last season's China teas are selling in England and Russia at wretched prices, showing a loss of 5*d.* to 6*d.* per lb. on their cost in China. A London correspondent of the *Times* considers that :—

"The one remedy for the present condition of things is that the great bulk of the so-called fine teas should be bought in China at their present value on this market—viz., at about 5*d.* to 6*d.* below the prices given for them in recent years. With the large accumulated stocks in Russia and consequently reduced orders from that country, the yearly-increasing supply of Indian tea, and the present prices here, one would think that such a course would at once be adopted. Unfortunately, however, so much of the tea is bought on commission, and the Russian agents seem so reckless as to the prices which they give, that any such prudent action can hardly be hoped for. It would, therefore, be wise for holders of shares in Eastern banks as well all who have been in the habit of intrusting orders to buying agents in China to ponder the foregoing facts, which can be easily verified by a reference to any of the trade circulars, lest their money should be lost in the crash which must certainly take place if the past policy of tea buyers in China be continued."

It seems probable that India will obtain with her tea a potential compensation for her loss of revenue from opium. Major Baring takes a desponding view of opium, and believes that the trade will show yearly a tendency to fall off. India's loss in this direction will be China's gain, for it will be attributable to the increased cultivation of the poppy in China. Similarly in regard to tea, China's loss is India's gain. But we do not like the prospect of having some day to seriously consider how to make good the loss of the seven millions sterling that India now realises from opium. The value of the tea exported from India in 1881 was less than half this sum. Obviously, however, our tea is doing India a good turn, and promises to do yet more for the land to whose soil it takes so kindly.—*Madras Mail.*

INDIAN TEA.

THE grievances which the Indian tea planters have laid before the Secretary of State are not wholly groundless, though the remedy should probably be sought in another direction. The most formidable matter of complaint is that Indian teas are "bulked" by her Majesty's customs—that is say, each chest is opened and emptied, in order to ascertain the exact weight of the tea and of the package. The planters say, truly, that this process greatly injures the quality of the tea, by exposing it to the humid atmosphere of London, and it destroys the air-tight lead lining of the chests, which never can be, or, at all events, never is perfectly reinstated. What the planters claim is that one or two chests only out of a "break" shall be opened, and the tare so found apply to the whole. The answer which the petitioners are likely to receive to their prayer is that the customs are not to blame for the bulking of Indian tea but the trade, who will not buy the tea unless it is bulked, for the perfectly sufficiently reason that the weight and tare of the packages, as well as the quality of the tea, are so irregular, that no average can be taken. Undoubtedly the bulking of Indian tea inflicts a serious burden on the trade, not only through the expense, but the destruction of the chests and their contents. The time, moreover, required to prepare the tea for sampling keeps it for a week or ten days out of the market after arrival. The remedy for this state of things appears to be to take another leaf out of that great Chinese book from which Indian planters have already taken so many. Chinese tea comes to market so perfectly packed, that in a break of 600 chests you will find an absolute uniformity of weight, both of package and contents and of quality, so that no repacking is needed, and the whole can be sampled and sold the moment the steamer breaks bulk. The reason is that the Chinese carry on their tea business on true commercial principles, while the Indian planters are still in the wasteful stages of a half-developed industry, and have not yet learned the full advantage of the division of labour. The planter is, or tries to be, merchant, carpenter, and engineer, as well, and one meets with persons holding shares in tea estates who harbour the delusion that they can not only send their tea to Calcutta for sale, but ship it to London, and, passing over the machinery of Mincing-lane, follow their pounds of tea into the consumers' pot. With such crude ideas of commerce, it is perhaps hardly to be wondered at that the Indian tea trade finds itself under some disadvantage.

The number of gardens in India is, according to the planters, 2,700 or 2,800, scattered over a wide area, and in very varied situations, and it would be absurd to look for uniformity or even reasonable similarity either in the product or the packages. The gardens are individually very small: yet every garden possesses a more or less elaborate plant, consisting of firing houses, rolling-machines, &c., and each has to keep up a staff of handicraftsmen to manage the machinery and to make the tea chests. The enterprise is thus severely handicapped at the outset, much as a small farmer would be who kept his own steam plough and reaping machine. The men and machines are necessarily half their time idle. The only true remedy for this is to organise a market on the Chinese method for the green leaves in the districts. Darjeeling is admirably situated for such a market, and there are several stations in Assam which would make most convenient depots for the purchase of tea. What is wanted is sufficiently strong companies or private capitalists to establish themselves at these centres, and set up all the necessary machinery for manufacturing and packing the leaf. The planters would then, like the Chinese, sell their basketsful of leaves as they picked them from the bushes. They would be planters, and nothing more, and the better planters for being nothing more. The tea-buyer, filling the functions of the *hong* in China, would collect the leaves in large storehouses, sort them out according to quality and kind, and manufacture the tea on a large scale with the *maximum* of skill and *minimum* of cost. The *hong* would pack the tea in large breaks of uniform quality, in chests of uniform size and weight, and such teas would never require to be bulked again, either in London docks or anywhere else.

The advantages to the planter of such an organization as this would be manifold. In the first place, he would be relieved of the great load of financial anxiety which he bears at present. He starts the season under a mass of debt to the Calcutta agents, which has gradually to be worked off during the producing season. These advances cost very dear, and the repayment cannot be made till the tea has been gathered, manufactured, packed, and sent down by slow transport to the Calcutta market. Whereas, on the *hong* system, the planter would require very little advance at all, seeing he would need no machinery nor any expensive staff to work it, and he would receive his money as fast as he gathered his tea, instead of waiting two or three months for it, as at present. The chief difficulty in the way of this innovation would be the strenuous opposition of the Calcutta agents, who make good revenue out of the tea-planters, not only in the way of interest on advances, but commission on sales of tea and on supply of stores and machinery. For once a tea concern is under the protection of a Calcutta house, it is an understood thing that it is nearly impossible to escape therefrom. The emancipation of the tea planters from this thraldom would fill them with new energy, and probably enlarge their intelligence.

Calcutta is at present the mart for Indian tea, mainly because under the present *regime* the tea has to pay toll to the finance houses there. Calcutta will always be the great shipping port for tea, nor is there any reason why it should not continue to be a market also; for the tea-buying establishment which I have been supposing at Darjeeling, Gowhatty, &c., would have quite enough to do to bring the tea down to Calcutta in a state fit for the London market, without following it any further. There will always be plenty of buyers for the London market in Calcutta.—*Correspondent of the Times.*

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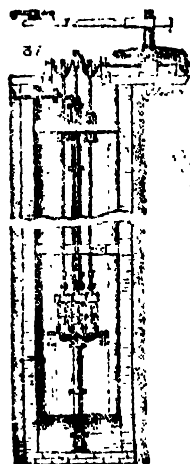
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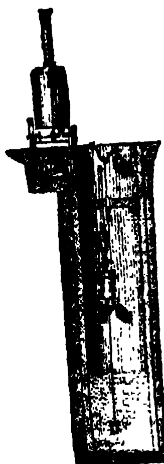
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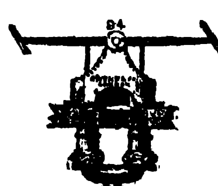
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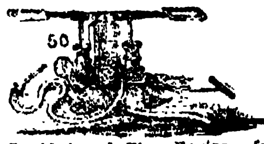
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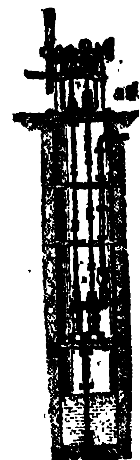
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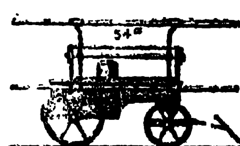
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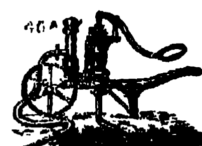
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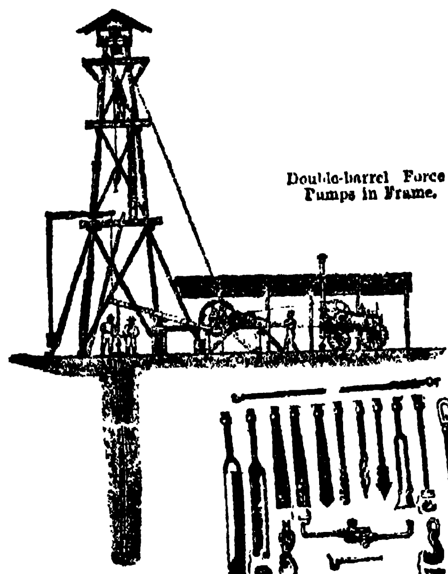
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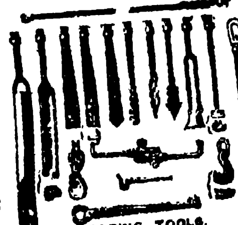
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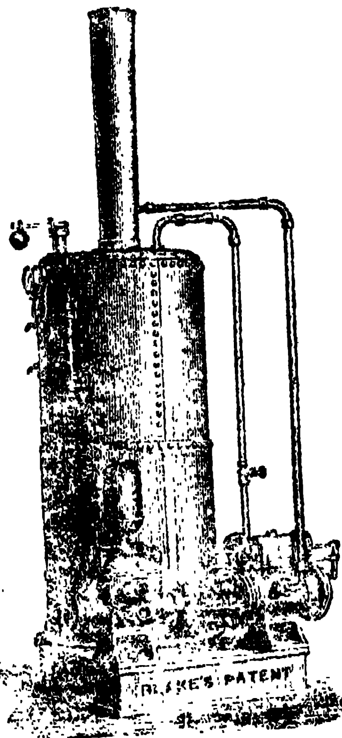
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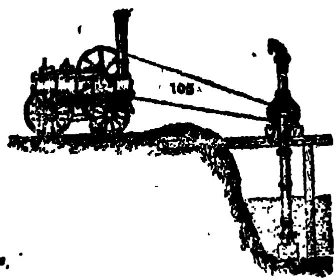


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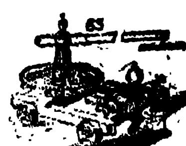
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All communications concerning the general business of the STATESMAN AND FRIEND OF INDIA *Office, Advertisements, and Subscriptions to the* daily STATESMAN AND FRIEND OF INDIA, weekly FRIEND OF INDIA AND STATESMAN, *and* INDIAN AGRICULTURIST, *should be addressed to the MANAGER.*

All communications regarding literary matter should be addressed to the EDITOR *of the paper for which it is intended.*

WILLIAM RIACH.

June 13th, 1881.

CONTENTS :

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGMENTS.

THE *Indian Forester* for June.

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REPORT on the Meteorology of India in 1881. By Henry F. Blanford, F.R.S., Meteorological Reporter to the Government of India.

RECORDS of the Geological Survey of India, Vol. XVI. Part 2, 1879.

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CALCUTTA, JULY 2, 1883.

AGRICULTURAL MAXIMS.

IT does at first appear astonishing that Hindoos, essentially an agricultural people, should be so ill-provided, if at all, with works on agriculture ; but the surprise is to a great extent removed, when we reflect that the great mass of Indian agriculturists are illiterate, and are well provided with instructive maxims and tales which may be supposed to supply the place of books very fairly, with the superior advantage of being suited to the capacity of the people. These proverbs, generally in rhyme to render them easy of recollection, are obviously of great antiquity, and, having stood the test of generations of practical agriculturists, may reasonably be supposed to be of considerable value.

What we wish to suggest is that these rythmical proverbs, as well as set phrases and tales, should be collected by some means from all parts of India, and after revision with the object of expunging indecent expressions which, with a little ingenuity, may readily be replaced by more parliamentary ones, a book should be compiled from the information contained in them, due allowance being made for the mythical and marvellous which pervade all Indian literature, and, as in the case of Indian history, must be collated before tangible conclusions can be arrived at. Agriculture, however, is such a practical subject that a condition involving an entire dependence on marvellous fables could never exist, and this difficulty will no doubt be easily overcome. The thoroughly practical tenor of the following proverbs, which I give in the Birj Bhesha (the language of the sacred circuit of Muttra the purest Hindi spoken, I believe), will show that cultivators themselves recognise the absurdity of depending on mysterious omens alone :—

Ghar me saro swarehi, aur tina ke sikh Sacan gai luraito to tino mango bhik.—

which, translated, means :—You will go begging should you do either of the following three things,—*1st*, sit at home idling with your able-bodied relatives (brother-in law in the rhyme) ; *2nd*, take the advice of women, and *3rd* (which is to our purpose), go searching for omens as to the proper time to sow your seed

after the month of Savan (between 12th July and 19th August 1883) has passed.

Karam bout jai khot na towte—

Which really means, Let fortune desert me, provided I retain my manure.

Ban pé ban karé to bhag malûm paré—

Sow cotton in a field that had cotton in it (the previous season), and you put your good luck to (a severe) test.

These proverbs clearly advise not to depend on omens and luck, but to work hard, following well-known and substantial practices.

Setting aside the value of it to uninformed people desirous of following agriculture in India, the book would surely be of the greatest use to officers of the Agricultural Department. It would facilitate their endeavours to introduce improvements, as it would give in a very accurate form the opinions and practices of the mass of the people in various parts of the country, obviating in a measure the possibility of erroneous impressions being formed, and perhaps very often save the expense of experiments: as these ancient proverbs can only be looked upon as conclusions, the results of experiments of the highest order. It would also shew scientific men clearly what is known, and what remains to be known by natives.

Dictionary form is perhaps the very worst for conveying information of this sort, and it would probably be best to combine in the same book with a list of the maxims, which should be numbered, a treatise based solely on information contained in them.

For instance, the following proverbs, numbered from 1 to 5, have reference chiefly to cotton :—

(1.) *San ghano—Ban béyro—médki phandî Juârpérn pérn par Bâjra-gandaro se bôr.*

Hemp should be sown closely. Cotton scattered. Juár about the jump of a small frog (a span) apart, and should bajrá be sown a pace (5 feet) apart, the cobs will be as long as the axle of a well wheel.

(2.) *Ban mé ban kare to bhag malûm paré.*

Sow cotton after cotton, and we will ascertain the quality of your luck.

(3.) *Do patti cheon na narâe aur binat cheon pastâe.*

You did not weed your cotton when it shewed but two leaves; now why do you repent while picking?

(4.) *Jo barsingî Suânti renthâ chale na tântî.*

Should it rain in the zodiacal sub-sign of Suânt (between 22nd October and 5th November) neither the cotton gin or cotton beater's bow will work.

(5.) *Jonhri kahat kisân se hai ki beg naraé, nahni nahni gâr de, aur bhutta vahlilala â', to rot tu khawaûn. Ban ké hai ki tent, bhej wa me té diwaûn. Lil kabrae? Lil ka jhuto jhagro aur kahe Girdhar kabrâe chând par bâjo jûto.*

Jonhri says to the cultivator—Sow and weed me well, ploughing over me with close furrows (when a few feet high) and I will give you ears that will bend with their weight and feed you with bread. Sow cotton and I will pay your rent with the produce of the pods, but as for indigo, oh, poet! it is a mistaken business, and says Girdhar the poet, shoe-blows will resound on your head (for your folly) in writing about this product.

These could be put in the following form, giving the numbers of the proverbs—

(No. 1) Cotton should never be sown closely but as far apart as possible, (No. 3), and should be weeded while very young and before the plants have thrown out more than two proper leaves: without this early weeding, the produce is certain to be very indifferent. (No. 2) Sowing cotton in a field that has had cotton in it the preceding season, is found by experience to be very bad; and under ordinary conditions no hope of a good crop can be entertained where this is done. (No. 4) Rain in the days contained in the zodiacal sub-sign of suanth (between 22nd October and 5th November) is ruinous to cotton and reduces the harvest to a mere nothing. (No. 5) Cultivators depend greatly on cotton as a means of paying their rents, and make it a principle of looking upon it as a crop set apart specially with this object.

Of course, with more maxims, &c., to refer to, reasons could be given and pages of valuable instruction written.

Perhaps it would be necessary in preparing the book to devote a few pages to astronomical matters, such as the 12 signs of the zodiac further divided into 27 parts, called Naichattras, the names of which are continually in the [illegible] of cultivators and others interested in agriculture, as all calculations with regard to time of sowing, ploughing, &c., are regulated by [illegible] periods. Each zodiacal sign contains 2¼ of these subsigns or Naichattras, meaning 9 canopies, I presume, there being 9 in each 3rd section of the year. The following table compiled from the Hindi almanac, published monthly at Agra, will show the English dates for the present year on which the sun passes through these signs. The hours and minutes have been omitted :—

	* 1	2	3	4	5	6	7	8	9	† 10	
Naichaitras ..	Asnni.	Bharni.	Kirtka.	Rohni.	Mirgsir.	Adra.	Punarbas.	Puk.	Aslekha.	Magha.	
	12th	25th	9th	23rd	8th	20th	4th	18th	1st	15th	29th

Zodiacal signs called Râs	Mékh Ram 1	Birg Bull 2	Mithun Twins 3	Karak Crab 4	Singh Lion 5
	12th	13th	13th	18th	15th

Month English	March. 1883.	April 1883.	May.	June.	July.	August.
	24th	23rd	23rd	21st	21st	19th

Month Hindi ..	Cheit 1940 Samlat.	Baisakh.	Jét	Asâr	Sâvan.	Bhâdour.

	11th	12th	13th	14th	15th	16th	17th	18th	19th	20th	21st	22
Naichattras ..	Purwâ Phalagunî.	Uttrâ Phalagunî.	Hast.	Chittrâ.	Suânth.	Bisâkha.	Unradha.	Jeshta.	Mul.	Purwâkhar.	Uttrakhar.	Sirwin.
	12th	25th	9th	22nd	5th	18th	1st	14th	27th	9th	22nd	

Signs of the Zodiac ..	Kania Virgin. 6	Tul Scales. 7	Brischak Scorpion. 8	Dhan Archer. 9	Magar Sea-Goat properly Crocodile. 10
	15	16	15	14	12

English months	September.	October.	November.	December.	January 1884.
	17th	17th	15th	15th	18th

Hindi months ..	Kuar.	Katik.	Aghan.	Pus.	Mag.
	23	24	25	26	27

Naichattras ..	Danashta.	Sathikna.	Purwa Bhadrepad.	Uttra Bhadrepad.	Reoti.
	4th	17th	2nd	16th	28th

Signs of the Zodiac ..	Kumb Water pot. 11	Min Fish 12
	11th	12th

English months ..	February. 2	March. 3
	12th	13th

Hindi months ..	Phagun.	11 days of Cheit Sambat 1941.

The following proverbs will show how their Naichattras are spoken of :—

Chana Chittra Changuna suanthan gehun hot.

Grain sown in Chittra (14) will be four times more fruitful (than if sown at any other time), but wheat grows best when sown in Suanth (15).

Pūk Punarbas baiyé dhān Aslēkhā kodon parmān Maghā masino baiyé phér aur ūn hārān har dijio jhér.

During Puk (8) and Punarlas (7) sow rice, in Astekha (9) at the very [illegible] sow *kodon*, after this in Magha (10) sow *masinā* (or [illegible]ash and mot vetches) ploughing these fields well

Jo barségā Uttrā nāj na khawé kuttrā.

Should it rain in Uttrā phalégunā (12) the very dogs will turn up their noses at bread (grain.)

Mirgsir na bāi na bādiān, Rohnā natapé na Jet.

Adrā Jo barse nakin to samé ki net.

No heat in Rohnā (4) or in the month of Jet, no high winds in Mirgsir (5), and if added to this there should be no rain in Adra (6), the season is ruined.

Jai din Jét chalé Purwai, tai din Sāvan sūkho jāi.

For every day you have an East wind in the month of Jet, you will have a dry day in the month of Sāvan.

Though these proverbs having reference to the *naichattras* may not be quite correct, they must be somewhere very near the truth to influence, as they do, thousands of practical agriculturists.

It may be mentioned that it is by no means an easy matter to collect these proverbs; people cannot readily recall them to memory when called upon to do so, and further, a man may be an excellent practical agriculturist without knowing more than a very few, though this does not appear to throw any doubt on the opinion expressed here that these proverbs, to the illiterate cultivator, really answer the purpose of a treatise on agriculture, for we know, judging from analogy, that one may be an excellent practical man without having read and studied any books treating of his profession. It would of course be far easier to get information from cultivators in the ordinary way, but Europeans have, and with justice, such an indifferent reputation for being able to procure correct information from natives, chiefly on account of the great disregard for truth displayed by the latter, and no doubt in some measure because of their not mixing with them, that bare assertions will always be received with doubt. How often do we find carefully written notes on agricultural subjects, rendered useless by the writer being obliged to acknowledge his own doubts as to the accuracy of statements he has made, because of the tendency manifested by his native informants to suppress the truth?

The support of ancient adages or maxims would, no doubt, be generally regarded as ample testimony of the correctness of statements made regarding Indian agricultural matters, and prove very interesting to readers, particularly those in search of information wanted for practical purposes.

There are generally a few old cultivators in each village or clump of villages with the reputed talent for remembering proverbs, &c., and collectors could procure a great number from them. It would also be advisable and facilitate matters to record reputed facts, and then search for maxims supporting them. For example, cultivators tell one that rain immediately after weeding injures and blights a crop, particularly cotton, and that a few days' dry weather intervening is beneficial. The knowledge of this palpably renders the scheme of securing a maxim supporting it much stronger.

W. C.

ON THE IMPOVERISHMENT OF THE BERAR SOIL: WITH SUGGESTIONS FOR ITS REMEDY.*

THE Indian cultivator has a very good idea of the value of manure in increasing the amount to be got from his land, in the shape of a crop; but his ignorance of the value of available manures, and the inherent productiveness of the soil, hinder the practical application of this knowledge. The manures which he believes in are cowdung and ashes, but these, owing to certain economic considerations, such as cowdung being used as fuel, can only be applied by him in limited amount. The garden and irrigated land solely get the benefit of it, none being available for the ordinary fields. The mutual relation between animals and plants is disturbed, and the rule which makes it necessary that the waste products of animals should be returned to the soil for the use of the vegetables is continually violated. Owing to the shorter life of plants, cultivated for the food of animals, either directly or indirectly, any such breaking of this law is more quickly manifested by them than by animals: but sooner or later these latter suffer also. The stunted forms of the Gonds and Koorkoos are good examples of how a whole race may be reduced in size by insufficient food, and what has happened to them in their less productive soil, will overtake the inhabitant of the plains who is reducing his land to the same powerless state by withholding from it its natural food—manure. The carbonic acid, dung, and urine must be placed near the plant for its use, but instead of doing this, the cultivator takes no care that they can be so utilised, and the result is that year by year plants find less food in the soil, and become smaller and smaller each successive crop, until they cannot be grown with profit at all. When this happens land has to be thrown fallow, and a certain portion of the food-producing surface of the earth is lying idle and inactive.

The question is, what are the best means at our disposal for averting this result?

Before going to the question of manure, we may consider one means by which this state of exhaustion may be delayed. If grass seeds were sown at some regular interval of time on these plots, the land would obtain a rest, and it has been ascertained by Baron Liebig, that by growing grass on the land, not only is it not exhausted or merely rested, but the grass contributes to the nitrogenous supply of the soil, storing up ammonia in it for future use. I think that one great step would be taken if one of the numerous Indian grasses were selected, as rye-grass has been at home, and grown as a crop in a certain rotation. The production of this grass crop leads to a consideration of an easy method of extending the manurial resources of India. It is customary for a ryot who wishes to manure his field, to induce a shepherd to bring his flocks at night and herd them on it. The soil gets the benefit of the droppings and the urine. This herding is done for three or four nights, and the shepherd is paid for it. If the cultivator sowed some grass seeds on his land he could turn the matter to his own profit by getting the shepherd to pay for the grazing, and get the benefit of the manure as well. By adopting this course, some practical measures might be evolved which would be of use; but of course the subject needs to be thought over and worked out, as no one could at once produce a system of rotation of crops which would be applicable to a whole province, or even for many contiguous portions of it, as the soil varies so suddenly and so much. The rotation of crops is so intimately connected with non-exhaustion and husbanding the resources of the soil, that manuring and it must always be considered together, when any practical scheme for the non-impoverisation of the land is being drawn up. As farmyard manure practically does not exist in India, this plan of eating over a crop, seems one peculiarly suitable, and worthy of some trouble being expended to secure its adoption. By it, the whole of the nitrogenous materials of manure are secured for the soil. The urine that is voided on the earth is fixed in the soil as ammonia and remains available for future use. It is surprising how little of it escapes into the atmosphere, even on the top of a dunghill little ammonia is given off, though it is being formed in it to a large amount. Much less escapes from the earth which has the power of absorbing and retaining it. The droppings should not be removed from the soil, but allowed to remain on it, the rain will wash their nutrient properties down into the earth when they become converted into nitric acid by the rootlets of the crop, and are thus stored for future use. The crop which should be grown after the land has been thus treated will vary in different cases according to the character of the soil, but as a general rule, it may be laid down that the best paying *rabi* or spring crop cultivated in that part of the country will be the one to sow.

* By Surgeon T. Hume, M.B., Amraoti.

With reference to fresh nightsoil as a manure, I have made some experiments, and find that in certain instances the result has been most satisfactory; the cases in which it failed, I will also mention as they may be of benefit to others. I had a large amount of nightsoil wherewith to experiment, *viz.*, the daily outturn of a central jail containing 500 prisoners. This had always been thrown into deep pits in morhum, and was thus quite unavailable for all present or future use at the place where it was buried. Natives could not be induced to try it as a manure, and besides the almost insuperable objection they had on the score of caste, they insisted that it burnt up all crops, that it was too strong, &c. Despite these representations, I ordered the nightsoil—which had been mixed with about twice its weight of dry earth inside the jail—to be carried out into the garden, and there buried in trenches, from one foot to fifteen inches deep. The amount of the poudrette was six inches deep in the bottom of this trench, and over it a small basket of lime rubbish to each running yard was thrown. The whole was then covered over with the earth that had been excavated. In a month or two, I began cropping the ground, and raised on the first trial a beautiful crop of radishes—the large country radish, which are almost equivalent in bulk, I should say, to a garden turnip. I also tried it with bendikai with a like good result, as far as the experience of the plants was concerned, but the outturn of pods did not show such a marked improvement as the enlarged size of the plants would have led one to expect. The next crop I tried was carrots, and this was an unqualified success. Onions did remarkably well on this trenched ground; cabbages and cauliflowers were very luxuriant. Now for my failure—cotton; the trees grew to a great height, some of them being 6 and 7 feet high, but the crop of cotton from them did not correspond with this growth. The number of flowers was large, but the cotton while in the boll was attacked by an insect (a beetle) which lived on the seed, ate it out leaving nothing but the shell; and indifferent or destroyed cotton fibre was the result.

I am sorry that the above experiments were undertaken without any idea of their ever being reported, and that the crops have to base their claim to excellence on my opinion and testimony instead of having had their actual weights registered. Improvement to the crop and the utility of the manure there can be no doubt, as it was remarked by every one who saw the crops.

The point gained is the use of fresh manures, and that manure of the strongest nature. There is no doubt that this was attained by the lime rubbish which was buried with the latrine offal. I have seen the experiment recorded of some manure or putrescent substance which was treated with solutions of different kinds: one contained lime, one of the other was perchloride of iron. The substance to which the lime was added decomposed with the utmost rapidity. There is no further proof needed than this, and the testimony of experience that lime is the key by which the farmer opens and liberates the stores of nitrogen contained in manures, and in the soil. It served this purpose most effectively in those experiments of mine. While approving of the use of lime when applied to the soil, it is evident from what I have already said, the more you apply it the greater is the necessity to supply manures for it to work upon. I know of no more certain rapid exhauster of unmanured soil than lime. If therefore any attempt is made to utilise fresh nightsoil one indispensable concomitant is lime. I may here note an ancient belief with reference to lime which holds sway in the best farmed country in the world, that lime rubbish, *i.e.*, old mortar which has been in a building for some time, is the best suited for such a purpose as I have described. I suppose that quick-lime is too rapid in its action, and overdoes the decomposing, forming chemical compounds not beneficial in large amount to plant life. Here, then, is an unused and valuable aid to manuring: if it is not a manure, but the lime of all old buildings is of service when put on land with manure.

Another lesson which these experiments taught me, or rather forced on my notice, is that those crops which come to maturity as a crop before they flower and seed, are much benefitted by this abundant and readily available store of manure, and that those whose utility depended on their fruits, as bendikai and cotton, were not so benefitted. The over-luxuriance of the crop in the initial stage predisposes to premature decay whenever the period of growth is over, and hence the inability of those crops whose economic purposes begin to be developed after flowering, to resist the downward tendency. Manures, more intermixed with the soil, and more [illegible]posed, will suit these crops better than the fresh manu[illegible] next year I have no doubt that this ground which has failed now will grow very fine seed crops. Small seeded crops, like radishes, carrots, mangold and cabbages which require in a short space of time to increase to a large size, require that there should be a large store of available manure to assist them in their rapid growth, while it is not so necessary in the case of slower growing, and smaller growthed plants like grasses, cotton, wheat, &c. This is the reason of the practice followed at home of giving manure to a green crop, such as turnip or potatoes, and not to a white crop such as wheat, barley or oats.

I have tried the effect of urine buried in trenches on a jowari crop, and found that it improved the crop, both straw and corn, in a marked degree.

The plan I can recommend for farm-yard manure and field refuse is a simple and efficacious one, which I commend to al who own stock and have fields. I dig a pit in the hard morhum four feet deep and about thirty feet square; into this I throw all the stable litter, cowdung, and the rank green vegetation that I can cut down in the compound till the collection reaches the top. I sprinkle over the whole of this a few baskets of lime and old mortar and cover it with a foot of black cotton soil. Of course any other good soil would answer the purpose just as well; it is put there to catch any ammonia that may be disengaged, and also to absorb any possible malaria that might be given off by the fresh vegetable matter during the early stages of decomposition. In less than six months the whole is as decomposed as manure need be, and fit for application to any soil, or for any crop requiring it. There is no loss of liquid draining away the soul and substance of the manure as it is retained in the rocky basin during the rains, and absorbed by the solid manurial substance during the cold weather. This means of converting the rank vegetation and weeds into a modification of one of the best manures we are acquainted with, *viz.*, leaf-mould, is one that should be extended. By it the whole nitrogenous matters are preserved, whereas by the native plan of burning, only the saline matters are retained and given to the soil: the nitrogenous are dissipated by the heat.

I have not attempted here to give a dissertation on agricultural chemistry, as that has already been done by men who are much better versed in the subject than I am; the whole aim of this paper has been to be practical, and record what I have done for the guidance of those who may be inclined to try similar experiments.

There are numerous substances which if utilised as manure would be of immense benefit to the soil; but every one of these apparently availables ubstances has some difficulty connected with it, in the way of its being employed. For example, the numerous dead carcases of animals could, when made into compost, be used as manure. At present they are devoured by pariahs, kites and crows, and are not utilised as manure at all. But the rights of mahars (or pariahs) prevent this means of fertilising the soil being carried out. The hereditary privilege of eating carrion, the prescriptive right of gorging on animals that have died either a natural death, or from disease is not to be interfered with unless the pleasure of these luscious repasts can be made up to them in some other way. Dead animals covered up with earth and left to decompose would be perfectly sanitary, and from them a large amount of nitrogenous manure, as well as phosphates, would be obtained.

The money value of this aforementioned plan of fertilisation is quite uncertain; it must vary much in different localities. As Government is the landlord, it must be from it that any regulations about rotation of crops must emanate. It can do this with all equity when it has ascertained what rotations are suited to various localities. In England no landlord would let his land without a definite agreement about

the cropping that was to be followed; he must do so to protect his land from exhaustion and himself from poverty.

The foregoing is a brief indication of the means by which this exhaustion of Berar soil may at once be remedied. The points of having a good grass for fodder which could be sown on the land which is now thrown fallow would benefit the cultivator, by giving him a fairly remunerative crop, benefit the land in that it, by its chemical actions, would store nitrogen in the soil, the principal deficient plant-food in the soil of India, and allow the ground to be at once resumed as a productive cultivation area.

A FEW OF THE BOMBAY CENSUS FIGURES.

STATISTICS in some countries, and notably in India, are not only fearful and wonderful productions, in some respects passing all understanding, but in the hands of what now-a-days are called experts, and others who cannot be imagined to be experts, are made to perform feats of such astonishing dexterity as to bewilder and astonish even the very men who had a hand in conjuring them from the vasty depth of probability. Different men handling the same figures may so manipulate them as to evolve conclusions seemingly quite at variance from the natural conclusions lying on the surface, and so often does the warfare of controversy rage round figures, that it has passed into something like a proverb that "nothing is more misleading than facts unless it be figures." Statistics come to the bulk of mankind, unsophisticated mankind, in the guise of eternal verities, which it would be something near akin to an unpardonable sin to refuse to accept fully and unreservedly. They are supposed to be truth in a condensed form, truth winnowed of fancy and probabilities, truth at all events as it presents itself to the understanding and intellect of those who go down to the great depth where truth lies gulphed in the many waters that roll over its head. Men are beginning to realise, more forcibly perhaps in this than in previous generations, that their highest knowledge is but a great ignorance, and so, while the forcible power of dogmatic assertion grows less, the spirit of a wider toleration broods over the mass of cultured men. There are conditions at work in India which render the compilation of statistics in this country probably a matter of more exceptional difficulty to secure anything like results that will at all approach something near the truth. What these are, it is needless here to enumerate; they exist, and figures, computed with the greatest care, and after making every allowance for possible, probable and known contingences, are, after all, even in countries more favoured in this respect than India, approximations to truth rather than representations of the actual truth. The census of two years ago gave occasion for the compilation of statistics of all sorts on every conceivable subject connected with the people, and amongst the latest of these to come to hand is the operations and results of the census in the Presidency of Bombay, including Sind. We are bound to say that Mr. Baines—under whose supervision the work in that presidency was carried out, and whose two bulky and lucid volumes have just been issued from the Government Press—has grouped and reasoned from his figures with a masterly touch which does infinite credit to himself and the Government which he serves. Though this journal is nominally supposed to deal in matters statistical, it has come to be accepted that the statistics it deals with should have some bearing near or remote to the leading topic of its columns, *viz.*, agriculture. We therefore propose to place before our readers a few of the figures from the Bombay Census Report, so far as these have a connection with agriculture. One of the first general facts that strikes the reader of the results of the census operations in Bombay is, that the total population increased during the nine years intervening between the last and the previous census by 1·03 per cent only. The total increase is composed of a decrease of 0·28 in males, outweighed by an increase of females amounting to 2·48 per cent. This decrease of males and small increase on the whole population is of course due to the great famine which was felt over an area of 50,000 square miles in a population of over 20,000,000, and which has left its mark in other directions besides those noticed above. There has been an increase in persons of both sexes above the age of thirty in all the worst famine districts, and in the case of women over fifty the increase is quite as marked as it is in the decrease of young persons under nineteen. This is easily explained by the fact that the males suffered most—more than females—in the worst periods of the famine and the following years, scarcity of food and insufficient nourishment made themselves apparent in a large diminution of births. The total number of persons engaged in agriculture, or dependent on those so engaged, is 10,015,477, but of these 52·5 per cent are at work, and the remainder supposed to be unoccupied. If Sind is omitted the agricultural population is 8,675,238, that is, more than 64 per cent of the whole population, and of these 4,753,602 or 54·9 per cent are workers. The ratio varies of course for the different divisions, but the figures given above are representative of the whole presidency. It may easily be conceived with what dire results a famine would be followed which fell among a populace more than half of which depended for existence on the gathering of a single harvest. This 64 per cent, directly depending on agriculture for a living, does not however represent the actual state of the case as it exists all over India. There is not a village tradesman, trader, or worker of any kind who does not depend more or less on the agricultural classes, because a very sensible proportion of their earnings is paid not in coin but in kind, and when harvests fail the agricultural population drag down to poverty and want all those classes dependent more or less on the wages received in kind from the ryots. It is the utter dependence of all ranks and classes of Indian communities on the safe gathering of the year's labours of the agriculturist that renders the failure of a single monsoon the herald of widespread poverty, ruin and death; and which, taking one year with another all over India, renders it imperative that the Government of India should be prepared to spend on an average yearly £2,000,000 sterling in famine relief, or on works which have an immediate connection therewith. We have probably said enough to render it evident that the great problem for Indian legislators is an agricultural one, if, indeed, the fact has not already in a hundred other ways made itself apparent. Population increases in a more rapid proportion than the land can supply food. The land of India is a known concrete factor, the population is an unknown quantity, ever increasing, checked at intervals by famine and its consequence. How shall outlets for this ever-increasing population be provided?—is the problem which must be taken up, and solved sooner or latter: the sooner the better.

THE CENTRAL PROVINCES.

THE report on the trade and resources of the Central Provinces for the year 1881-82, recently issued, is the first report of this nature that has been written by Mr. J. B. Fuller, since his assumption of the office of Director of Agriculture in those provinces, and is characterized by the thoroughness and completeness which were a feature in the reports issued by him when he was in the North-West Provinces. The report in question deals with the resources, manufactures, traffic communications and trade of the provinces, and some interesting information is given under each of these heads.

We see that the total area under crops during the year was 16,154,489 acres, of which 13,704,057 acres was under food crops, and 2,450,402 acres under non-food crops. Food grains occupy 84 per cent of the total area, and of these wheat and rice are the most important. Of the area under non-food crops, oil-seed and cotton occupy 1,557,661 acres and 666,031 acres, respectively; sugarcane 87,084 acres, tobacco 24,896 acres, fibres 31,009 acres, and vegetables 48,626 acres. There has, we observe, been a gradual increase in the total area under crops during the

past three years, the crops which show the largest increase during that period being wheat and oil-seeds. The area under rice which, during 1881-82, is shown as 4,039,555 acres, has been almost stationary during the last three years, and that under the coarser grains has declined a little.

The chief minerals of the provinces are said to be coal, iron, and the stone and lime of the Jubbulpore district. The output of coal at the Mohpani mines, which are worked by the Nerbudda Coal and Iron Company, was, during 1881, 10,454 tons, the royalty paid to Government for that period amounting to Rs. 1,819. The coal beds at Warora are, however, of more importance, the output of during coal 1881-82 having been 68,156 tons against 25,696 tons in the preceding year. We see it stated that extensive coal fields have recently been discovered at Muaria, in Rewa territory, 34 miles across their northern boundary, and are believed to extend into the northern portion of the Jubbulpore district. It appears that the Betul district has also been credited with coal beds which have been the object of extensive boring operations during the past two years. The Geological Department selected three sites for the sinking of bore-holes to the depth of 400 feet; the work has cost Rs. 11,096, but the results are reported to be unpromising. A fourth site has, it seems, been selected for deeper boring in the hope of striking richer strata.

Iron is not yet worked on an extensive scale. It is said that there are about 48 small iron mines in the hills to the north of the Jubbulpore district, while several mines are also to be found in places in the Saugor district, which, during the year, yielded 36,863 maunds of ore. Referring to the iron of the Chanda district, which was formerly a native industry of some importance, it is reported that the resources of the district have recently been investigated by Mr. Ritter von Schwartz, a gentleman of considerable experience in iron working in Austria. His report has, it appears, been a favourable one, and is now under the consideration of Government. Mr. Schwartz thinks that "with the construction of proper furnaces, there would be no reason to doubt the possibility of Chanda turning out a very large quantity of iron or steel, and that an export trade to Europe might even be opened in certain articles now imported from the continent, such as ferro-manganese and Brescia steel."

The amount of stone quarried in the Jubbulpore district during the year is returned as 391,050 cubic feet, particular mention being made of a quarry which yields a stone of some value for the manufacture of chocolate paint. We observe that the lime excavated at Murwara is said to fetch a high price in the Calcutta market; the amount quarried during the year was 160,416 cubic feet, for which as much as Rs. 48,125 was realised.

Turning to the manufactures of the provinces, we see that the cotton mills occupy the most prominent place therein. During the year under report, the amount of raw cotton worked up was 33,895 cwts., the amount of twist manufactured 1,804,530 lbs., and the amount of cloth manufactured 1,494,945 lbs. The value of the cloth and twist is put down at Rs. 1,593,864. The Nagpore and Hinghunghât cotton mills are reported to be in a very flourishing condition, the outturn of the former having greatly increased during the last two years owing to the introduction of the electric light which allows work to be carried on both night and day. Cotton mills are also about to be established on the Nerbudda, where it is intended to utilise water-power for working them. Among the handicrafts of the provinces, weaving, metal working, carpentry, and the manufacture of gold lace and silk goods, appear to be the most important. The report says that "the cloth of Chanda is reported to have been of extraordinarily good quality, and at the commencement of the century was exported as far as Arabia. Similarly the brass-work of the town of Bhundara, of Lodhkihera in Chindwara, and of Hurda in Hoshungabad bore an excellent name, and the Chanda and Jubbulpore districts were noted for the manufacture of durable utensils from the iron which is found within their limits. It is universally reported that both the weaving and metal working industries have suffered severely from the competition of European goods. Cotton cloth and metals constitute the principal return which England makes to these provinces for the grain and oil-seeds which she draws from them, and the value of articles included under these two heads amounted to 40 per cent of the total value of the imports by rail during the year under report. It is not therefore surprising that from every district there should come the same account of declining profits, of the emigration of the artisans to places further from the railway, or of ruin only averted by a change of trade. The decline commenced with the substitution of English materials for those fashioned by native craftsmen. Thus, rolled sheet brass came into use in Bhundara and Lodhikera in place of that beaten out of by hand, and English cotton yarn was preferred by native weavers to that locally spun." A curious and interesting feature in the manufacture of lace at Burhanpore is the drawing of silver-gilt wire of astonishing fineness from a bar of silver, called a *passa*, which is lightly or heavily gilt as the occasion requires. The report says that "the *passa* is of a uniform weight of 60 tolas, and its manufacture and the preliminary process of wire-drawing are conducted under municipal supervision, and made the source of a small income, a duty of Rs. 1-8-0 being levied on each *passa*. The weight of gold-leaf to the *passa* varies from 4 to 42 *mashas*. A *passa* is often drawn out into a wire 72,000 yards in length, and the length of wire per tola of weight varies between 500 yards (for gold lace sold by weight) and 1,200 (for spinning the thread of mixed silver known as *kalabathe*.)"

The following figures will give an idea of the extent and value of the trade of the provinces during the year. The imports by railway amounted 39,97,667 maunds, valued at Rs. 3,58,89,598, and the exports reached 1,64,93,192 maunds, valued at Rs. 4,75,11,826. The imports consisted of coal, cotton goods, fibres, metals, salt, spices, sugar, and tobacco, while among exports we find coal, cotton, fibres, wheat, *ghee*, linseed, teelseed, and other grains. The railway trade is distributed between the East Indian, Great Indian Peninsula, Warda Coal, Nagpore and Chuttisgurh, and Rajpootana-Malwa Railways.

The total weight and value of the trade with the adjoining native territory is shown as follow :—

	Maunds.	Value. Rs.
Imports ...	10,41,778	46,37,641
Exports ...	7,82,237	49,52,358

The principal items of import are cotton, grain, opium, *ghee*, and oilseeds; and the export trade is confined to cotton goods, grain, metals, spices, and sugar.

THE ARTESIAN WELLS OF PONDICHERRY.

THE Government of Madras has recently published some interesting notes by Deputy Surgeon-General Furnell, the Sanitary Commissioner for Madras, on the artesian wells of Pondicherry. Dr. Furnell's visit to Pondicherry was to make himself acquainted with the artesian well water-supply, as well as to ascertain the extent to which the cholera epidemic of 1881-82 had affected the settlement. Dr. Furnell tells us that, in his capacity of Sanitary Commissioner, he is chiefly interested in artesian wells as affording a water-supply for domestic use, and that whether they are useful for irrigation purposes or not, is a question which does not concern him, except indirectly. We observe, however, that their inutility as a means of irrigation has been conclusively settled by the local Public Works Department.

It is stated that there are now about 14 artesian wells scattered over the town of Pondicherry and its neighbourhood, and that in different parts of the settlement fountains, with water laid on from these wells, give an ample supply of good and pure water for the use of the people. In his remarks regarding the different strata encountered in the

construction of these wells, Dr. Furnell says that at the Sarana Cotton Mills, he was shown a number of sectional diagrams of the borings which were "ingeniously constructed, showing the actual strata in position, not drawings, but the sand, laterite, argillaceous sand, &c., themselves *in situ*," and that he was much struck with the various and dissimilar strata of the different borings. In some wells he observes that the "principal strata are alternate layers of gravel mixed with clay, lumps of black plastic clay, coarse blackish sand, mixed with black clay, &c."; while in the one situated in the town itself, which he inspected, "the strata were all more or less of hard, almost impenetrable material, thus described—quartz, argillaceous sand, coal, sable gros grains, quartenz, lignites, débris des roches primitives, minerais-de-fer, laterites gris ferrugineux, &c." This particular well is said to have been commenced on the 16th August 1879 and completed on the 27th September 1880, at a cost of only Rs. 1,000. It was bored to a depth of 82 metres or 338 feet, and the result is said to be an abundant supply of good water. Dr. Furnell's remarks regarding the nature of the water are interesting. He says that "it is warm, clear, with a distinctly ferruginous taste. It is used by the natives for cooking and drinking, and its slightly ferruginous taste comes to be liked after a short time. It is in high repute medicinally; skin affections are said to disappear under its use, and many natives of respectability come from English territories to drink the water for diabetes; indeed, lately at Madura I met a highly intelligent Brahmin gentleman, who informed me he had been residing in Pondicherry for some time to drink these waters for an affection of the kidneys, and had derived much benefit therefrom." The analysis of a sample of the water from an artesian well has been given as follows by the Chemical Examiner to the Local Government:—

Total solids, grms. per litre	0·43
Volatile solids, do.	0·12
Sodium chloride, do.	0·047
Total hardness, Clark's scale	9°·8
Permanent hardness, do.	2°·8
Free ammonia, mlgrms. per litre	*Nil.*
Albumenoid Ammonia, do.	0·02
Nitric acid, do. (as ammonia)... ...	1·2

Remarks.—A good water.

As regards the cost of the wells, it is stated that those at the Sarana Cotton Mills have cost about Rs. 2,000 each; others have cost Rs. 500, while it is added that "a native in Pondicherry is very willing to undertake sinking wells on a salary of Rs. 150 for himself per month, finding the machinery, but of course not paying the coolies, the pay of whom must be defrayed by the person employing him."

In the report on artesian wells furnished to the Madras Government by his Excellency the Governor of the French Settlements, the notes collected in connection with the most recent borings made by the Government, as well as those made by the Civil Engineers, are also supplied. It appears that seven artesian wells have been bored since August 1880. We select one which was constructed in 1881 at the Sarana Cotton Mills; it was bored between the 26th March and the 27th April 1881, and the following notes, recorded by the engineer who executed the work, may not be uninteresting to our readers:—

Height of the soil above the mean level of the sea...	3·20 metres.
Depth of the well in the soil	26·20 "
Diameter of the orifice at its outlet ...	0·18 "
Discharge of water per minute at 0·20 centimetres above the soil on the 20th April 1881	200 litres.
Temperature of water at the orifice of outlet	32° centigrade.
Hydrotimetrical degree of water ...	10°
Hydrostatic level of the spouting sheet of water above the soil	1·00 metres.
Hydrostatic level above the mean level of the sea	4·20 "

During the execution of this work, the sounding lead met with a series of the following layers:—

No. of layers.	Composition of the ground traversed.	Thickness of layers.	Depth of layers.	Remarks.
		M.	M.	
1	Ground lately embanked ...	0·27	0·27	
2	Vegetable earth ...	0·25	0·52	
3	Brown and blue clay	0·25	0·77	
4	Clay marbled with reddish, yellowish and greyish spots with a mixture of sand and carbonate of lime ...	0·55	1·32	
5	Sandy clay with veins of yellow, brown and some garnets ...	0·40	1·72	
6	Large size sand, soiled with brown clay ...	0·30	2·02	m. 2·20 level of sheet of water of surrounding wells.
7	Large size sand with clay ...	2·50	4·52	
8	Large size bluish sand, mixed with small pebbles and refuse of rotten wood, pieces of plastic clay, rolled up pebbles, basalt, and amphibole ...	2·08	6·60	
9	Grayish fluid sand and mica mixed up, agglomeration of black clay, basalt and amphibole ...	0·50	7·10	
10	Grayish black thin sand, black spots, (titanate of iron) agglomerations of black clay, basalt and amphibole ...	0·50	7·60	
11	Black plastic clay, broken up shells, refuse of rotten wood ...	4·70	12·30	
12	Medium size sand and also fine, soiled by black clay, bits of shells, refuse of rotten wood ...	1·00	13·30	1st ascending sheet of water, 1st April 1881, at 8¾ o'clock morning; hydrostatic level of sheet of water, m. 3·20 of the soil.
13, 14	Bluish earth, large and medium bits of shells, refuse of rotten wood ...	3·90	17·20	2nd ascending sheet of water, m. 0·35 above the soil.
15	Black plastic clay ...	5·30	22·50	
16	Black sandy clay ...	0·50	23·00	3rd ascending sheet of water, level of the soil.
17	Black plastic clay ...	1·50	24·50	
18	Medium size sand with mica soiled with black clay ...	0·50	25·00	
19	Medium sand, mica, soiled black clay ...	0·60	25·60	
20, 21	Large size bluish sand (basalt and amphibole) shells, broken pieces of bricks, bits of shells, refuse of rotten wood ...	0·60	26·20	

The spouting sheet of water was met with at the depth of m. 26·20 in a layer of bluish large-grained sand mixed with pebbles, some small shells, and rotten wood. Its hydrostatic level rose to m. 1·00 above the soil, and its discharge of water on the 20th April 1881 of 200 litres per minute.

SERICULTURE IN THE DOON.

IN the last administration report (1881-82) of the Agricultural Department of the North-West Provinces and Oudh, some interesting information is given regarding the prospects of sericulture in those provinces. We learn that the enterprise is now in the hands of Messrs. Lister and Co., of Bradford, whose manager, Major Murray, has already done a good deal to push on operations on the lands which have been granted to the firm in Dehra by the Government of the North-West Provinces and Oudh. It is stated that 50,000 seedling mulberries and four acres of cuttings—of both the *sinensis* and *multicaulis* varieties—are now on the Song grant, and that a canal measuring 4½ miles has been dug for the purposes of irrigation. It is pointed out, however, that one of the chief draw-backs which Dehra offers as a centre for sericulture is the want of leaf. A very small supply appears available at present, and it was owing to this deficiency that a good portion of the silkworm seed put down by Major Murray during 1880-81 had to be thrown away. During the year 1881-82, "12 ounces were put down, and even then there was not enough leaf for night feeding, though the trees were stripped for three miles round. Moreover, the roadside trees, not being manured or tended, threaten to give a continually diminishing supply."

Cottage cultivation does not appear to have been very successful. The production of silk by villagers during the official year 1880-81 amounted to 12 maunds 24 seers green, for which they were paid at the rate of Rs. 40 per green maund. In the Punjab, it is stated that the same quantity obtains Rs. 16, Rs. 20, or Rs. 24, according to quality, while in Calcutta a maund of dry silk fetches from Rs. 80 to Rs. 100, and is really equivalent to three green maunds. In the face of these rates, the report goes on to say, that to pay Rs. 40 for a maund of green silk must result in a loss to the purchaser. During the year under notice, the price offered to the villagers by the firm was Rs. 20 per maund, but only two cultivators were found to agree to these terms, the quantity of seed taken by them amounting to 4 ounces, which gave a produce of ten seers of silk to the ounce. Notwithstanding the obstacles which the firm have had to contend with, it is satisfactory to learn that they hold the opinion that "Dehra offers a very fine field for the cultivation of healthy seed, and that if a remunerative price were guaranteed, an almost inexhaustible supply might be depended on." In connection with this matter, an important question suggests itself to the Agricultural Department, which seems deserving of attention. It is whether the importation of healthy seeds by silk-growers in the Bengal presidency, while helping to augment the supply in the Doon, might not also serve to revive the silk industry of Bengal. The difficulties which, it appears, at present obtains in the way of providing supplies in the manner indicated, is due to the fact that Messrs. Lister and Co. are at present the only silk-growers in the Doon, and it is thought that they might not care to undertake the enterprise. It is stated, however, that the matter has been brought to their notice in view of eliciting their views thereon.

What is chiefly wanted to make sericulture successful in the Doon is mulberry trees and rearing accommodation. As regards the first, the report says that "the initial difficulty is that trees to be of any use must be within a short distance of the rearing sheds. It hardly pays to carry them three miles, and certainly not further. The land near Dehra is already taken up by crops and gardens, and is so extremely valuable that it is doubtful whether to plant it with the mulberries, which might after all never be used, could be justified. To plant trees in the jungles is to anticipate on insufficient grounds the locality which a future silk enterprise might select. The forest department, who were addressed with the view of establishing mulberry plantations, offered the sites of two deserted villages at a distance of about 24 miles from Nynee-Tal, and not nearer any other possible commercial centre. The cost would have been Rs. 7,000, and the trees would have been of no use whatever except for silk working. This offer we see was declined by Messrs. Lister and Co., and the project was abandoned. Arrangements, however, it appears, have been made with the Superintendent of the Doon that a small garden at Dehra should be planted out with trees, and it is stated that further proposals are under the consideration of Government, which involve both the growth of mulberries and the provision of proper rearing sheds for cottage cultivation. The report mentions a second silk concern which has been started in the Doon by Colonel Utterson, but [illegible] at present it cannot be depended on for seed.

EDITORIAL NOTES.

BEE-KEEPING in India has never gained a footing among the paying industries, and the Government of India think there is no prospect of its being made an important source of remuneration to the labouring classes, even if they take up the matter seriously, and place facilities in the way of encouraging the natives, who alone could undertake bee-culture in this country. The chief obstacle to giving bee-keeping an impetus is the want of a sufficiently large and influential staff of officials competent to instruct the natives, and interested themselves in the matter. Perhaps the only practical bee-keeper in India is Mr. John Douglas, of the Telegraph Department, who is not unknown as such to both the Home and Indian Governments. Bee-culture is not quite unknown in the upper provinces, and in some small tracts of the southern presidency of India. But the mode of keeping bees here has been of a most primitive type, and not calculated to encourage the extension of the industry, for the returns for labor are small; and only such as have had time and little trouble have interested themselves in it, and have utilised the outcome of their labors mostly in home consumption. The same may almost be said of the bee-keepers of the Himalayas, who, after providing for home use, retail the balance in the bazaars of our various hill sanitaria. In Cashmere, however, we may accept it, on the authority of Mr. Moorcroft, that the bee is domesticated, and its produce calculated upon as the harvest from an acre of land. There, its domestication appears to be complete, and in some parts of the territory a provision is made for beehives during the construction of the houses of the people. According to the system in Cashmere, the hiving and abstraction are done in the simplest form—the latter by the smoke of a smouldering wisp of straw introduced into the hive, and so well provided for are the inmates of the hives in the matter of accommodation, that shortly after being deprived of their hoard they are induced to return and commence collecting another store. It is a common thing for the same colony of these insects to produce honey year after year in the same hive for several generations. H[illegible] been literally domiciled with man for so very many years, the bees of Cashmere have the reputation of being "milder in their manners than those of any other country" (so the papers of the Agricultural Department tell us), although they are said to have "a most villanous sting"; and Mr. Moorcroft tells us that their produce is "as pure, clear and sweet as the finest honey of Narbonne." The Indian Government, under the guidance of the Agricultural Department, sees enormous obstacles to the introduction of the bee industry into this country, stating that there exist no natural resources for the subsistence of the bees on the plains. But one would ask, why a hive depôt could not be established at each hill station in India where there is always a large growth of indigenous flowers, &c., and by which the objection of the Government would be removed. Mr. Buck expects to have some important information afforded him on this subject at the forthcoming International Exhibition in Calcutta, and till then the question has been shelved. As other more important subjects w[illegible] occupy the Government at the Exhibition, it is not likely this will be given a thought to, especially as it was received from the first in a half-hearted manner. Mr. Douglas went to much trouble in collecting information on the feasibility of establishing bee-culture in India, and as an expert in the matter is hopeful of its success; but the Government of

India—perfectly unacquainted with the subject—finds numerous objections, which, if it were disposed to favour the industry, could easily be removed. But the Agricultural Department, apparently knowing nothing of the matter, discountenances the scheme, and it, therefore, receives no support from the Government of India.

The report of forest administration in the Central Province during the year 1881-82 shows that the forest area at the disposal of the local administration, at the close of that period, was 19,719 square miles, as against 19,666 square miles at the end of 1880-81. The total area is divided as follows :—

First class, reserved	...	...	2,588
Second "	...	...	16,842
Unreserved forests	...	...	289

The total number of forest offences during the year is stated as 9,228, or almost double that of the foregoing year. The report, however, explains that "it must not be implied that there has been any increase in the number of offences, or any greater tendency to disregard the forest law, but there can be no doubt that the record of cases reported has been more complete, and that, on the whole, the arrangements for watch and ward have been better." In the first class reserves there were 451 cases of breach of forest rules. In 21 cases prosecuted, 18 resulted in convictions; in 3 cases the offenders were not detected, and in 427 cases the persons were allowed to compound. In the second class reserves the offences amounted to 8,779. The cases prosecuted were 777, of which 716 resulted in convictions; in the remaining cases the persons concerned were allowed to compound.

The results of fire protection do not appear to have been very satisfactory. The area attempted during the year was 904,582 acres, as against 924,380 in 1880-81, while the area actually protected was 773,893 acres, as compared with 869,828 acres in 1880-81. The proportion of failures to the area attempted was, therefore, 14 per cent as against 6 per cent for the preceding year.

The cultural operations of the year have not been very extensive, having been confined to two divisions principally; for one, the minor division, the expenditure amounted to Rs. 4,137, while the different works undertaken were the cultivation of a stock of fruit trees at Girgaon, the raising of evergreen trees along the boundary in the Kandwa reserve, the maintenance of the Girgaon nursery, and the pitting of land, and planting out. The plants put out were teak and bamboo, but it is feared that only a small proportion have succeeded well. In the Saugor division the expenditure, which amounted to Rs. 2,074, was spent on maintaining nurseries, the protection and cultivation of a field of 50 acres sown in the previous year with bamboo, the fencing of bamboo previously put out, and the putting out in the natural forest of 67,000 bamboo clumps, of which 27,600 are reported as successful.

The financial results of the year show, we observe, a great improvement as compared with the figures for the year 1880-81. The revenue derived has amounted to Rs. 11,72,884, against Rs. 8,50,139 in 1880-81, while the expenditure was Rs. 4,97,013, or only Rs. 1,500 more than it was in the preceding year. Of the total revenue, Rs. 3,10,176 represents the receipts on account of the timber operations of the year.

The following letter from W. R. Robertson, Esq., Agricultural Reporter to the Government of Madras, to W. Wilson, Esq., Director of Revenue Settlement and Agriculture, Madras, dated Saidapet, 15th April 1883, and endorsement by the Director of Revenue Settlement and Agriculture, has been printed by the Madras Government :—

I have the honor to suggest that the undermentioned Aden stock might with advantage be imported :—Fifteen young bulls ; six cows, each with a bull-calf at foot. Our last importation of this stock in 1881 consisted of—Two bulls, four cows, and four calves ; and the entire cost of the importation was Rs. 900-5-8. The average cost per head would thus be per bull Rs. 150 : per milch-cow, with calf, Rs. 150. At the foregoing rate the animals I now propose should be imported would cost here Rs. 3,150.

The bulls should be about three years of age and the cows not over 4, each with her first calf which should be a bull-calf. Preference should be given to animals suited as dairy stock. The importation should not, I think, be made until the south-west monsoon is over. It would, I think, be best to send two farm laborers to Aden to receive and look after the cattle on the voyage here ; this course would not be more expensive than that followed on the last occasion, when two Arabs accompanied the cattle here, and afterwards returned to Aden.

Numerous applications have been received from different parts of the Presidency for the loan of Aden bulls for use in improving local dairy stocks. It seems very desirable that these applications should be met. We will shortly have some Aden bulls available at the farm for stationing in some of the districts, but the number is small.

If the foregoing proposals are approved, I suggest that the bulls available at the farm next cold season should then be distributed. The bulls to be imported should, I think, go to the Saidapet Farm until they have recovered from the effect of their voyage, when such of them as are then fit might also be distributed for use. The cows I would keep at the farm until the up-country Experimental Stations are opened, when one cow and a bull also might be sent to each station.

The endorsement on the above, submitted, through the Board of Revenue, for the consideration and orders of Government, is as follows :—

"The Aden breed of cattle has been much admired by the deputations of ryots who have visited the farm from different districts. They are peculiarly docile and good tempered, while possessing every quality that can be desired for purposes of draught. They are of medium height, and the bulls would therefore serve admirably for the improvement of the small, and too often poor, breeds that are to be found in many districts of the Presidency. Mr. Robertson's suggestions are, therefore, recommended for sanction.

The Farm Budget for the current year provides only Rs. 1,500 for the purchase of live stock, and the required funds would have to be provided by supplement from the Agricultural reserve. Passage for cattlemen to and from Aden and the cost of fodder and freight for the cattle from Aden must be added to the estimated price of the bulls and cows ; the probable amount of these items will be ascertained and reported.

The following is the Government resolution on the subject of Bee-keeping in India :—

In November 1881, the Government of India was furnished by the Secretary of State with copy of a correspondence with Mr. John Douglas, of the Indian Telegraph Department, then on leave in England, on the subject of bee-keeping in India. Mr. Douglas, who had studied the industry as followed in Europe with a view to its introduction into this country, desired to be supplied with information regarding the varieties of honey bees indigenous to India, and the results of past efforts towards their domestication, extent of the demand for honey, the quantity produced, and the prices realised. In forwarding the papers, the Secretary of State remarked that the subject appeared to be of sufficient practical interest to engage attention. Local Governments and Administrations were accordingly requested to furnish such information as might be available on the subject.

The replies received comprise a large number of interesting reports by Forest and District officers and other persons who have paid attention to the subject. As the information may be useful to the naturalist or the bee-keeper, the reports have been printed, and will be made available to the public. The broad conclusions to be drawn from their perusal are—(1) that several varieties of honey-bees are found in every province of India where there is sufficient forest of jungle, and that the honey of some of the varieties is good and in considerable demand ; (2) that efforts have been successfully made in the hills by Europeans to domesticate Indian bees, but that bee culture is only practised by natives in the very rudest way ; (3) that it is very doubtful whether the bee could be domesti-

cated in the plains owing to the dearth of flowers during the three or four months preceding the rains; (4) that in Southern India persons (Mr. Stormont of Bombay and others) have given up all attempts to domesticate the most common variety of bee found there on account of its intractable nature.

The industry is unlikely ever to be one of great importance in India. It can only be followed in the hills, where flowers abound throughout the greater part of the year, or in forests, where food is equally plentiful. In the populous country of the plains, bee-keeping as a general industry seems impracticable. Under these circumstances, there is little or no call for action on the part of Government. Such action could only assume the form of improving the system of bee-culture in the hills and forest region, but the Government of India does not at present see its way to taking any practical steps in this direction. Opportunity will, however, be taken of the Calcutta International Exhibition to make some further enquiries in the matter. With this object, Local Governments and Administrations are invited to authorize their respective Agricultural Departments, &c., to forward to the Exhibition specimens of honey, naming, if possible, the variety of bee by which it is produced, and the specimens will be submitted to examination by experts.

FROM the experiments that have been made on the Cawnpore Farm, there is some hope of sorgho superseding the cane at some future period. The plant possesses three advantages over cane. The first is, that it yields a grain fit for human food; second, it makes excellent fodder for cattle; and third, it occupies the land for only four months of the year, while cane takes it up for a whole year. Then, in addition to this, sorgho requires scarcely any manure and no irrigation. Every one will admit these as considerable advantages over the cane; but the difficulty with sorgho is in the manufacture of the sugar, and this is where the experiments of the first year were unsatisfactory. Three varieties of the plant were tried during last year, the amber and the red descriptions producing a somewhat less proportion of juice and *goor* to the whole plant than uncleaned sugarcane; but rather a larger proportion than the cleaned canes. The *goor* manufactured from the sorgho, though it had a peculiar acidity, was well-flavored, clean, and commanded a higher price in the market than that produced from cane. It appears to have a good future before it for eating and various manufacturing purposes. When the farm officers procure improved machinery and have taught the natives how to cultivate the plant, to manufacture *goor*, and put it to other paying uses, then perhaps the expectations of the Agricultural Department of the N.-W.P. and Oudh may be realised in regard to the superiority of this plant over cane as a sugar-producer.

A VERY large trade is done in the Central Provinces in wood, principally teak, which is so plentiful in Nagpore and adjoining towns that it is used even in the most common carpentery for the most trivial want. I do not know, says a correspondent any reason why the Central Provinces should not supply a great portion of this wood to the markets of the world, and why Burmah should have the monopoly of supply, when there are hundreds of square miles of teak wood available in these territories, size and quality equal to the best Moulmein. Thousands of squared beams are brought in from the outlying forests from 1 to 2 feet square and sold at an average of from 8 annas to 12 annas per foot, and as the cost of carriage from here is dear, are wasted principally in supplying sleepers to the railways. Such misuse should be officially prohibited at once, more especially as great forests of the other strong and durable woods exist, chiefly *sál*, more convenient to the railway lines than the supplies of teak. Besides the supply brought to his doors, the railway contractor has the pernicious habit of selecting the most convenient trees from 10 to 12 inches in diameter in forest tracts—those that will split up into 4 or more longitudinal sleepers—which, if left, would rapidly acquire dimensions of five to six feet in depth. So ruthlessly is his work prosecuted, that whole forest areas, which are generally of one age, take only a few seasons for the tree to become totally extinct. If the railways reduced their rates for the carriage of this wood, I am positive that at once sufficient quantities would be transported to Bombay, and that the high prices ruling for Burmah wood—the monopoly of one or two firms—would at once have a fall. When the through railway is a *fait accompli*, your market will certainly be supplied. I think it is the imperative duty of the Government to stop, and at once, the ruthless destruction of this tree, and take all forests, whether feudatory or otherwise, under their protection; conserving them, and at the same time making their wealth available in an intelligible and imperial disposition, not treating these forests and their produce in the spirit of petty peddling and huckstering prevalent in this province. A certain amount of large trees should be felled each year at the different forests; or contractors, on paying the authorised demand, should be allowed, under direction, to fell for themselves and take away the logs; and for every tree thus cut three seeds or seedlings should be put down. I would venture to state that were this advice systematically carried out by the State, the Central Provinces alone would for ever supply the wants of the world in this wood. There are, say, taking a low calculation, from 3½ to 4 millions of large available teak trees on British and feudatory territory, in Pannabarras, Bustar, in the Raepore and Chanda districts and at Allapillay (in the latter the most superb trees have been viciously destroyed by some Forest Department officials in their zeal to supply sleepers to the Nagpore State line); and if, say, 20,000 logs were annually cut down, in a hundred years half the useful wood will have been felled, and in the meantime a supply would be ready from the systematic sowings. But besides Government have at this time well selected reserves, many square miles in area, in which teak trees of all ages, from saplings to 10 to 30 year old trees, exist in inexhaustible numbers, and before the hundred years we have allowed, expire, these would be available to supplement the recognised store;—such is the source from which, I say, if judiciously conserved, an annual supply of teak can be drawn—practically unlimited.

THE results obtained last year, says the *Farmer's Review*, in the production of sugar from the sorghum plant on a commercial scale, and affording a profit to both the grower and manufacturer, were such as to practically settle the question in favor of sorghum as a profitable sugar producing plant. These results were but the culmination of long series of experiments and careful study, which have extended over a series of years in various parts of the country, during which time the character of the plant and the influence of climate, soil and cultivation upon its juices, have been carefully studied, and its juices, subjected to careful analysis, at various stages of its growth, to determine the particular stage in which they reached their maximum saccharine quality, and also to discover those properties which hindered the crystallization of the sugar contained in them, and how they can be effectually removed.

All these problems seem to have been solved, as shown by the success attending the sugar production from sorghum cane at Rio Grande, N. J., and Champaign, Ill., during last year. It had already been demonstrated that syrup of a superior quality and of a high commercial value could be produced. But successful *sugar* production on a commercial scale had never been achieved until last year. Previous results in crystallization, which had been common, were accidental, and could not be relied upon. The importance of this question of domestic sugar production to the country, and especially to the farmer who must be relied upon to grow the cane, can hardly be appreciated. Its economic importance can best be shown by the amount and value of the sugars annually consumed in this country and the proportion of them we are dependent upon foreign supply for. The consumption of sugars in this country is said to be 44 pounds per capita of our entire population, which by the census of 1880 was in round numbers 50,000,000. Estimating our present population at 55,000,000 and on this basis our yearly consumption of sugar reaches the enormous amount of 2,420,000,000 pounds, or 1,210,000 tons, enough to load 80,666 railroad cars of 15 tons each, which, if stood in a line on single track, allowing 33 feet

to each car, would form a continuous line of 622 miles. This, it will be understood, includes sweets of all kinds, having a sugar as a basis. Of this amount, our total domestic production, including Southern cane sugar and molasses, sorghum sugar and syrup, and maple sugar, does not exceed ten per cent of our yearly consumption. During the fiscal year ending June 30 1881, the value of our imports of sugar, molasses, melado, confectionery, &c., as shown by reports of the treasury department amounted to $94,782,104. The duties collected upon the mamounted to $47,986,041, making the total cost of the importations for the year $142,768,145. Of this amount, nearly one hundred million dollars was paid to foreign sugar producers. The sorghum question involves nothing less (if satisfactorily solved) than the saving of this amount to the country and transferring it from the foreign grower to the American farmer and sugar manufacturer, for, as we shall show in future articles, the work of domestic sugar production from sorghum must be divided between the farmer who grows the cane and the manufacturer who converts it into sugar and syrup.

MR. THOMAS JAMIESON, F.I.C., F.C.S., chemist to the Sussex Association for the Improvement of Agriculture, has published a full and exhaustive report, giving an account of experiments conducted last year. The first part of the report deals with wheat-growing, the noteworthy facts elicited in connection with this being, that a moderate increase in the yield followed from the use of farmyard manure, and that the profit is nearly doubled on the plots judiciously treated with artificial manure. Artificial manures containing nitrogen were found to give a great increase, and Mr. Jamieson holds that the use of these need not exhaust the soil. The following mixture was found to give the best yield of wheat in Sussex last year. In autumn, before sowing and harrowing in the seed, a mixture was given containing per acre ½ cwt. sulphate of potash, ½ cwt. sulphate of lime (these might be substituted by 1 cwt. ground kainite), ½ cwt. ground coprolite flour (not gritty nor brownish), ½ cwt. steamed bone flour (as fine as wheat flour, or nearly so), 1½ cwt. nitrate of soda. In spring, say March, ½ cwt. sulphate of potash, 1 cwt. mineral superphosphate, ½ cwt. steamed bone flour, 1½ cwt. nitrate of soda. Mr. Jamieson strongly recommends farmers not to purchase these substances mixed together, nor indeed any mixture (under the name of wheat manure, mangold manure, champion manure, &c.), but to purchase the ingredients separately, and mix them for themselves. Experiments on roots brought out results similar to those of the Aberdeen Agricultural Association, namely—that undissolved phosphate has proved equal to the dissolved phosphate. The manure recommended for roots is contained in the following mixture for soil assumed to be very deficient in all the essential ingredients :—2½ cwt. coprolite flour, 2 cwt. steamed bone flour —to provide phosphorus ; ½ cwt. nitrate of soda, ½ cwt. sulphate of ammonia, ½ cwt. horn dust or dried blood—to provide nitrogen ; 2 cwt. kainite, ground—to provide potash. Under the division of analytical plots, the report says :—

" We now come to what I regard as the most interesting part of the work this year at this station—to results that may ultimately have an important bearing upon the economy of manuring. It will hardly be possible, however, to err by an excess of caution in forming conclusions from these results, until they are well confirmed. Briefly—but I state it under reserve—they imply a reduction of the essentials of plant life ; they appear to show that the mineral ingredients deemed essential to plants may be a much simpler group than the seven-sided one at present accepted; that the whole subject of manures may be simplified ; and that much useless expenditure in manures may be spared. We have all—agricultural chemists without exception, I believe—accepted as fact that a complete plant cannot be formed in the absence of any one of the seven mineral ingredients—nitrogen, phosphorus, sulphur, lime, magnesia, potash, and iron. In order to inform ourselves in regard to the character of the soils in the field stations, and also to show farmers the essential character of plant food, analytical or deficiency plots were formed at each field station. The results of last year were reported, and these indicated that full growth was interfered with only when nitrogen, or phosphorus, or potash was omitted. The omission of sulphur and of magnesia was attended with little or no decrease in crop. The commercial import of this subject may not be obvious to the general reader. If, however, sulphur be not essential, not only may we avoid using manures injurious to plants by containing sulphuric acid, but we need not insure the presence of that substance by adding sulphate of lime or sulphate of magnesia. Further, if so minute traces of magnesia and lime as are in Hassocks soil be sufficient, we need not apply these substances, but safely trust to the soil and to impurities in manure to provide all that is required. Practically, therefore, manuring would be limited to the provision of three substances, viz., nitrogen, phosphorus and potassium (potash). It will, no doubt, be understood that this doctrine implies no disregard of the beneficial action of lime, but would cause its action to be regarded and due chiefly to mechanical and decomposing action on the soil."

The following are the proposals Mr. Jamieson makes for 1883: 1. To continue the analytical plot at the field stations. The longer they are continued, the more decided should be the differences in the crops from the various plots, and the more reliable the information. 2. That the root plots should be cropped with mangolds, without manure, in order to show the lasting effects of the different manures already applied. 3. That wheat should again be grown with manure on the wheat plots of last season, in order to show whether profitable crops may be grown in soil from which heavy crops have been got, by treating with what are deemed soil-exhausting manures. 4. To ascertain quantity, and as far as possible, the quality of the produce from various grass seeds. A large number of new plots have been opened up, and sown with this end in view. The various grass seeds to be sown in spring. 5. To continue and develope the experiments at Hassocks Gate, mainly to further elucidate the question of the mineral ingredients absolutely essential to plant growth.

THE Victorian Government statist has issued his quarterly abstract, showing the estimated population of Victoria on December 31, 1882. The number of births during the year was 26,741 ; the arrivals by sea were 59,404 ; making a total increase of 86,145. The deaths were 13,630 : the departures by sea, 48,524 ; making the total decrease of 62,154. The net increase during the year was thus 23,991. The population, on December 31, 1881, was 464,222 males, and 418,010 females ; and on December 31, 1882, 477,507 males, and 428,716 females, or a total of 906,223. The apparent increase of population in 1882 (23,991) was greater than that in 1881 by 1,826, and although less than in 1880—the Exhibition year—by 2,160, was greater than in any other year since 1871 ; the increase by excess of recorded arrivals by sea over recorded departures by sea (10,880) was exceeded in 1880 by 780 ; but was greater by 3,558 than the same excess in 1881, and was also above that in any other year since 1870 ; the increase by excess of registered births over registered deaths (13,111) was, with the exception of that in 1875, the smallest in the last 14 years.

THE agricultural returns published by the *South Australian Register* show that the late wheat harvest has been the worst ever experienced in South Australia. The total produce was 8,273,000 bushels, giving an average of 4 bushels and 32lbs. per acre, which is 2lbs. less than the yield of the preceding year.

THE United States Consul at Auckland, writing on the trade and industry of New Zealand, says it is estimated that the forests of New Zealand cover an area of not less than 20,000,000 acres, the forests on the Crown lands alone being estimated at 10,000,000 acres; about 5,000,000 acres are the private property of the white or European population, and the remainder of the Maori, or native inhabitants. Among the many descriptions of timber grown, the *kauri* pine is considered one of the most valuable ; it is found only in the province of Auckland, and in that district it does not exist further south than the East Cape, and like the cedar, it is confined to the vicinity of the sea. The kauri forests cover about 60,000 acres of crown land, and about 120,000 acres of private property,

The trees often grow to a height of 200 feet, and measure from 12 to 30 feet in circumference; they are discovered occasionally with a rugged surface, and on being cut, the grain is found to be mottled. The kauri is exported largely in what is called "junk," the logs being squared with an axe, thus wasting a quantity of good timber. The annual output of kauri timber is about 110,000,000 feet, and the highest estimate of the amount of timber left in the kauri forests is 23,000,000 feet. The subject of conserving the kauri forests is at the present time attracting considerable attention throughout the colony, not only on account of the excellent timber it produces, but on account of the gum which exudes from the tree, and which for many years has formed the most valuable article of export of the province of Auckland. Next to the kauri, the *Kahikatea*, a species of white pine, is the most highly prized. It grows in the low lands in the vicinity of rivers. There is an immense forest of these trees between the Thames and Piako rivers, thirty or forty miles in length, and several miles in breadth. The kahikatea is found in the kauri districts, and but little attention is paid to it, notwithstanding the fact that its value, as a timber for building purposes, is becoming very generally known. *Totara*, a hard close-grained wood, is largely used in the south of New Zealand; it is a good sound timer, reddish in colour, and very durable. It is largely used for telegraph poles, and has attracted much attention during the last few years from the fact that it will withstand the disastrous ravages of the *Teredo navalis*, a sea parasite, common to the islands of the Western Pacific. *Puriri* is another hard durable wood; it is largely used in the construction of railway trucks. This wood is said to make excellent furniture, though it is not much used for this purpose. Another very valuable timor tree is the *Maire*, a native olive. It is hard, oily, and close-grained. *Pohutakawa* is a coast variety of a tree used for ship-building. This tree is one of the best known in New Zealand; large branches of it, bearing beautiful brush-like red flowers, are everywhere cut at Christmas for the purpose of decorating houses and churches. It affects rocky cliffs, its leaves are large and thick, of a greenish blue colour on the outside, and the inside perfectly white. The trunk is gnarled and twisted in every direction. The inland variety of this tree is called the "rata," and there is a curious growth clinging to the rata, which has been the cause of much speculation among scientific men. It has not yet been decided whether it is deposited as a seed in the forks of high trees, or whether it creeps up from the ground like the ivy. It is found as a mere thread on the trunk, and thickens and sends out side shoots, and intertwines, as the ivy intertwines the oak. In time, the large tree perishes, and the frail slender growth stands alone with its arms outstretched, embracing the circular space where its supporter formerly stood, and the stems that have grown around and about the same supporting tree will unite and form one hollow rata tree, with bark inside and out. Among the other better-known New Zealand trees may be mentioned the *Kawaka*, *Matai Tenekaha*, *Rawiai*, *Manoas*, *Kowhai*, *Miro*, *Hinau*, *Titoki*, *Horopito*, *Manuka*, *Pahautea*, *Tawai*. The number of saw-mills in the colony is steadily increasing, and it is estimated that there are 250 at present in operation, while in 1879 there was only 204; and at that time Mr. Levy, in a report to the New Zealand Government, estimated the yearly supply from each of these mills at 1,000,000 superficial feet, or about 200,000,000 superficial feet as the total annual product. It appears, from the statistical returns of the New Zealand trade, that the value of timber exported in 1881 amounted to £77,000, against £53,600 in 1880.

PLANTAIN CULTIVATION FOR INDIA.

(*Communicated.*)

Climate.

The real climate for plantain is the one which has moderate cold and heat; and which has the atmospheric air loaded with moisture,—in other words, *humid climate*. In such a climate plantain will grow, shoot and fruit very freely; and mature its fruit altogether well. Much cold helps to retard and make imperfect the processes of *involution* and *evolution*, thereby stunting the growth of stem, leaves, and fruit: and partially or wholly, according to the degree of cold, withholding the maturity of the fruit. On the other hand, much heat, by the rapid exhalation of moisture, so greatly exhausts the plant that it has scarcely strength left to grow, consequently gets perfectly scorched of the leaves and outer layers of the stem-sheathes. In illustration of this subject I might here add, in many parts of India, such as North-West Provinces, Oudh, and the Punjab, most parts of these provinces, where the summer season is fearfully hot, I have observed the plaintain so severely suffer during this season that during the rains, so to speak, it has to commence life afresh; and when the winter sets in, growth being imperfect, it has no power to muster sufficient strength to send out fruit-spikes: after the winter it has again to embrace the summer season which, as said above, serves only to destroy it,—thus, I have seen plantain growing and suffering, again growing and again suffering for a number of years, and never, or very imperfectly fruiting, which fruit never fully developing and ripening, but getting either scorched (if in the summer) or stunted (if in the winter).

Time of Planting.

The best and most inexpensive season for planting plantain is when the rains have thoroughly set in, *i.e.*, from the end of June to end of August. This applies to drier parts of India, such as N.-W. Provinces, Oudh, the Punjab, Central Provinces, &c., but in Bengal, Assam, and British Burmah, in addition to these two or two-and-a-half months, February to April will be equally suitable to plantain planting. Being altogether a succulent plant, having much water in its composition, the rainy season has peculiar advantages for the growth of this plant, which no other season, in Upper Western India, in particular, can supply. In Lucknow and Sitapore, both Oudh districts, I have planted plantain in all parts of the year, and grown it successfully, but by resorting to the costly means of artificial irrigation. I would, therefore, in point of economy and on chemico-physiological grounds, recommend the rainy season to be the best for planting in places wanting in the natural advantages of humidity in the soil of Bengal, Assam, and British Burmah.

Geographical Distribution.

Plants of the N. O. *musaceæ* are natives of various parts of the world; but all of them, on close examination, will be found to flourish under the same physical conditions of the atmospheric air and soil. The following is the natural geographical distributive scheme of all important cultivated edible species of the plantain and banana order as established by the researches of Professor Baron F. von Mueller, K.C.M.G., M.D., Ph.D., F.R.S. The wording and arrrangement are my own; but the subject-matter (from *a.* to *g.*) partly belongs to this distinguished naturalist and doctor, and partly to various eminent botanical authorities of older times.

(*a.*) *Musa Cavandishii.*—Native of China; has been translated to the South Sea Islands, where it is now extensively grown. *M. Cavandishii* has been found to succeed in Madeira and Florida (artificial).

(*b.*) *Musa paradisiaca.*—India is the native habitat of this most extensively cultivated species, which is said to have one hundred varieties.

(*c.*) *Musa sapientum.*—Insular India, extending to the Indian Archipelagoes.

(*d.*) *Musa troglodytarum.*—Older botanists mention its nativity to be in India. Baron Mueller, however, has ascertained it, in addition to India, to be indigenous to the Fiji and other Islands of the Pacific Ocean.

(*e.*) *Musa simiarum.*—Indigenous to Malacca as far as the Sunda Islands. This plantain, with its varieties, fifty in number, are also to be found in the Indian Archipelagoes.

(*f.*) *Musa Livingstonia.*—Native of African mountains of Sofala, Mozambique, and the Niger regions.

(*g.*) *Musa ensete.*—This plantain, the most magnificent of the order, is a native of the mountains of Sofala to Abyssinia in North Africa. I may add it is unknown in India to the masses of the people, existing perhaps in the Botanical gardens. Very eligible for introduction in India. The edible part of this plant is the inner stem.

(*h.*) *Musa corniculata.*—Native of Insular India.

Soil.

Loamy soil of the *calcareous order*, of the species having more *humus* and less *lime*.

COMPOSITION OF SOIL.

Clay	... ...	40 parts.
Lime	... ...	3 „
Humus	... ...	5 „
Sand	... ...	52 „
		100 „

Plantain will grow in any soil, even in the most *sandy*. In such a soil, in the Lucknow Agri-Horticultural Gardens, many species and varieties of plantain are growing; but are productive of bad results, since they neither fruit well nor are the fruits so palatable and nutritious as those of Lower Bengal, Burmah, China, and other places. Plantain requires good percentage of *clay* and *humus* in the soil without which, as a plantain grower, I can, from personal observations, testify that it is useless to cultvate this plant; especially where quality as well as quantity of the fruit are objects points undeniably every cultivator do and should aim at. Much *lime* in the soil is bad for plantain; in moderate quantity, it is highly beneficial. This I say from my failing to obtain fruit from plants grown on highly *calcareous soil*, in which slender stem and stunted appearance (sure signs of not fruiting) of plants of three years' standing, were the results. During these three years they never fruited; had, therefore, to be rooted up. But in soil having less lime, more *humus*, good percentage of *clay* and sufficient *sand* to keep the soil loose and friable, I have in six months, calculated from the time of planting, succeeded to grow off shoots two feet high of the tall varieties into almost full-grown size, measuring twelve feet high to the apex of the leaf, ready to throw out fruit-spike by the end of the rainy season. The off-shoots were planted in February, and the above height acquired by the end of July.

CHEMISTRY OF THE PLANTAIN PLANT.

The centennial composition of the plantain plant in a green or fresh undried state will appear from the following table, being the mean of 7 analyses:

	Water.	Organic matter other than water.	Inorganic matter or ash.	Total.
Leaves	80·15	15·90	3·95	100
Stem	81·5	14·95	3·55	100
Fruit, including rind ...	75·58	21·17	3·25	100
Total ...	237·23	52·02	10·75	300

Centennial chemical composition of the inorganic or ash portion, being mean of 7 analyses:—

		Leaves.	Stem.	Fruit including rind.
Oxide of Iron	...	...	1·00	1·86
Oxide of potassium	...	20·59	18·30	20·15
Chloride of potassium	...	15·43	14·43	10·52
Chloride of sodium	...	7·58	5·25	3·75
Oxide of calcium	...	10·97	11·25	15·26
Oxide of magnesium	...	2·66	3·28	4·75
Phosphoric acid ...	...	2·95	8·52	25·96
Carbonic acid ...	...	7·27	5·07	2·05
Sulphuric acid ...	...	1·76	1·52	5·15
Oxide of silicon ...	...	25·54	25·15	7·65
Waste, i.e., earthy matter, or oxide of aluminum ...		5·25	6·23	2·90
Total	...	100·00	100·00	100·00

The foregoing tables should be taken as approximate data of the chemical constituents of all species and varieties of the plantain plant. The tables have been constructed from analyses of seven different edible varieties of plantain in general cultivation in Bengal, and from there disseminated in other parts of India.

The organic principles of the plantain fruit are starch in abundance, and protein compounds, hence, the fruit is nitrogenous and excellent food. The pith of the stem and root bulb contain starch. These principles exists in different proportions in the same plant, and in different species and varieties, cultivation and fertilising matters in the soil having also much influence in augmenting or lessening them.

PARTITIONING, TRENCHING, AND MANURING OF SOIL.

The soil, measuring 660′ × 66′, or one acre, should be partitioned off breadthwise into 3 partitions by 2 water channels, allowing 2′ for each water channel; and having trenches 4′ each wide with intervening space of 6′ from border of trench to trench:—thus, we will have 660 ÷ (6′ intervening space from trench + 4′ width of each trench) = 66 trenches in each partition and (66′ 66′ ÷ (2′ space occupied by one water channel + 2′ space for the other water channel = 16—6″ = length of each trench, or length of each trench. These trenches, 330 in number, 26—8 long and 4′ broad each, should be marked and prepared, two months before the planting time by digging 3′ deep, one foot of earth of which should be thrown on two side-spaces on both sides of each trench. This finished, suitable manure or compost should be thrown in the trenches, thoroughly incorporated with the soil, and irrigated with liquid manure, if available, or with water. The irrigation is required for inducing physical changes in the soil by which the manure and soil are rendered eminently fit as plant-food ingredients. It might be omitted if natural irrigation by the fall of rain be available, otherwise it is indispensable.

UTILIZATION OF BLANK SPACES.

In the first and subsequent years of plantain planting much space is available, both in the trenches and in the space intervening them, which certainly can be utilized in various ways, for raising of seedlings and cuttings of various kinds requiring sheltered positions, and for placing pots, &c., containing *stocks* for budding, inarching, and grafting.

SELECTIONS OF OFF-SHOOTS, PLANTING, AND THE NUMBER REQUIRED FOR PLANTING AN ACRE.

The best size of off-shoots for planting is 2′ up to the apex of the highest leaf calculated from above the bulb. Smaller plants do not succeed so well being so very tender, and larger ones suffer from transplantation owing to the delay of springing out of fresh roots without which the plant cannot establish itself, also for the rapid and great exhalation of water from the stem and leaves.

Young plantain plants should be planted one foot deep, in the middle of the trench, preceded by a hoeing of the soil if possible, six feet apart from plant to plant in the same trench, and immediately irrigated. But it would be very desirable to so time the planting time, as to fall on rainy day or days, and at the time when it is fast raining; as the planting at this time would ensure economy and remarkably facilitate the establishment and growth of the plants.

From what I have said in this and previous headings it will appear there are 4 plants in each trench and as there are 330 such trenches in the acre, the number of plants per acre will be 330 × 4 = 1,320 plants, each of which eventually growing into a group of from 6 to 15 plants of various sizes.

IRRIGATION.

Where natural advantage of humidity of the soil does not exist, irrigation for plantain is very important. In such places the soil (trenches only), in which plantain plants are growing, requires to be constantly flooded with water by artificial means, in the summer and winter; and during the rains also if the falls of rain be at long intervals and scanty. When, however, the fruit-spikes have been sent out, total withdrawal, or in moderate quantity according to the nature of the soil and condition of the season, of irrigation should be made, to allow the sap to concentrate for the formation of new substances for the fruit, to be again applied when the fruits have established themselves on the spike.

AFTER-CULTURE.

This consists in the elimination of weeds from the trenches, hoeing round the plants, not less than six inches deep, and manuring once a year during the rainy weather.

TRANSPLANTATION.

Every third year plantain plants require to be rooted up, the root-bulbs deprived of the stems, separated, and only the healthy off-shoots or young plants planted out in the same trench which has been well hoed and manured. By doing this fresh vigour is imparted to the young plants which had to

struggle for existence between the intermining net-work of root of old plants, ripened, fruited and removed.

HARVESTING AND STORING OF FRUIT-SPIKES.

When one or two fruits on the spike have ripened, the spike should be removed from the plant, and the plant, also. The fruit-spike should be stored, *i.e.*, hung from the ceilings, in a warm air-tight room, to allow all the fruits to ripen.

YIELD.

The yield of plantain plant is very various owing to various causes. Again, two varieties or species not producing alike in the number, size, and quality of its fruit. The minimum, per spike or plant, is 80 fruits, and the maximum 500 fruits, of various sizes.

O. L. BRYCE,
Agri-Analytical Chemist,
Late Supdt., Agri-Hortl. Socy. of Oudh Gardens.

OFFICIAL PAPERS.

ALOE FIBRE.

THE following translation of extracts from Mons. Evenor de Chazal's lecture regarding aloe fibre and the recent improvements effected in the process of extraction, read before the Members of the Chamber of Agriculture at St. Antoine, in the Mauritius, on the 19th January 1882, has been printed by the Madras Government :—

The attention of the Chamber of Agriculture of Mauritius has been lately drawn to a new industry which is already being carried on, on a large scale, in that colony, *viz.*, the extraction of aloe fibre. A method has been lately discovered of extracting the fibre of the plant in question in a most economical way, and this discovery has carried a new element of prosperity in the colony. The first idea had been to employ, for the extraction of the fibre, the mills used for crushing the sugar-cane, and on this subject Mr. Cossigny writes as follows in his remarkable work entitled " Means of improvements proposed to the inhabitants of colonies." In the *pita* aloes, the Negroes, to their great advantage, find the material necessary for making cords and ropes which are useful in the Colonies, where they are substituted for hemp and flax ropes. This fibre serves to make up all that is necessary to harness animals of drought and burden. Threads of *pita* aloes are employed in Manilla for making pretty strong stuffs which are dyed in blue, and with which the inhabitants clothe themselves. I do not know whether at St. Domingo, or even at Manilla, they steep the leaves of aloes to separate the threads. This operation does not seem necessary when the leaves are employed for the making of ropes, but in the manufacture of stuffs, the steeping process would make the threads softer and stronger. It is apparently for want of this operation that the fibre is generally so stiff : the juice of the leaves should, therefore, be squeezed out by being passed through the cylinders of a sugar-mill ; afterwards they should be left to soak for a few days in stagnant water, which, aided by fermentation, would dissolve the gum contained in them, after which they might be washed in running water. We do not make use in the Isle of France and Bourbon of our *pita* aloes, which grow very readily in all sorts of soil without any cultivation. Besides the *pita* aloes, we should also cultivate the aloes of Socotra to obtain the gummy-resinous extract which they contain, which has a great consumption in India and in Europe. The Dutch Colonists practise this industry at the Cape of Good Hope. Besides hemp and flax, we have in our Eastern Colonies several plants which produce fibre. I shall mention especially the two species of aloes which are to be found in the Isle of France and Bourbon and which grow in the most dry and unproductive localities. Starting on the assumption that the leaves should be bruised in order that they may be more easily steeped, they at first made use of sugar-mills, but it was soon found out that the cylinders cut the threads, and the system was abandoned. So was the steeping owing to the want of water. Later on, they made use of mechanical beaters imitating the hand of man. At last the scraper was introduced, the discovery of which is claimed by several inventors and cannot possibly be attributed to any one in particular. The present mode of extraction consists of a pulley or wheel nearly as big as a common cart-wheel. This wheel is surmounted throughout its circumference by cornières, or scrapers, incrusted in the wood, and kept firm by means of pegs. There are 14 or 15 of these upon the whole circumference. If the wheel is five feet in diameter with about 15 scrapers, so arranged, it follows that there will be a space of one foot between each scraper. This pulley which is the essential part of the apparatus, is fixed upon a stand, and is put in motion like every apparatus of this kind by a propeller. Imagine now, in front of this pulley, which turns four or five hundred times per minute, a table like that which is found in front of cane-mills, only narrower, and at this table a piece of wood against which the scrapers of the pulley press. This piece of wood is called the *servante*. It is regulated by a screw fixed behind, and plays a very important part in the working of the apparatus, for, according as it is too tight or too loose, the fibres are either cut, or not sufficiently scraped. There ought to be between this *servante* and the scrapers a very carefully-defined space, as every thing depends on the way in which the *servante* is regulated.

You have now before you what manufacturers of fibres have agreed to call the *gratteuse* (scraper). This *gratteuse* is not perfect, but very nearly so, and, on seeing it work, one is surprised to observe what little power it requires and into what small particles it breaks the fibres. The man who works it stands in front ; he shoves the leaves rapidly one after another point fore[illegible]. The leaf, carried away by the rotation of the fluted cylinders [illegible]ich are under the hand of the workman, is scraped along its greatest length and returns the same way in the state of fibre, with the exception of a small portion, varying from 6 inches to 1 foot, which is called the *talon* or the trunk end of the leaf, that is to say, the thick end which adheres to the trunk. What shall they do with this talon ? Must it be cut as recommended by some, or must it be scraped ? But this second operation cannot be performed with the same apparatus. Which apparatus then should be adopted ? We now come to a new apparatus called the *casse-tête*. It is composed of a wheel identically similar to that of the *gratteuse* and surmounted like it with the scrapers, with this difference, however, that, instead of turning against a fixed *servante*, it turns on a movable wooden slipper 18 inches long which forms a lever or pedal. It has already been said that, after having passed the *gratteuse*, the aloe leaf, reduced to fibre for the greatest part of its length, still retains a thick end, called the *talon*. The workman who performs the second operation fastens the scraped portion of the leaves by bundles of 5 or 6 at a time to a hook which projects from the wooden slipper open under his feet ; then, placing his foot on the pedal, he sets it in motion from bottom to top in bringing it near the pulley, so that the scrapers, turning with the rapidity already mentioned, take away what remains of the non-scraped portion of the leaves, *viz.*, the *talon*.

The aloe, all varieties of which are not equally useful to our industry, is composed of a trunk around which are grouped spirally leaves varying in length from 3 to 7 inches. When looking at the leaves attentively, we observe that the part which touches the trunk is the fleshy part, the heaviest and the strongest. The leaf ends in a point with a solid thorn. All fibres necessarily come from the trunk, but they all do not reach to a terminal point as may be ascertained by tearing a leaf lengthwise. Those of the middle alone reach so far, those of the sides stop midway. The consequence is that when a leaf of the aloe is cut at any distance whatever from the trunk, such distance varying from 6 inches to one foot, all the fibres have been cut at one and the the same point. If we now suppose that it is this end that will be first scraped, all the fibres will necessarily be secured at their terminal point, when the leaf is turned for a second scraping. But this was not the way in which they went to work formerly. They at first placed the leaf before the apparatus *at its terminal point* ; then when three-fourths were scraped, it was turned back again to place the *talon* before the *casse-tête*. In this second operation the longest fibres alone are retained at the hook ; the others are carried away by the rapid rotation of the pulley, and are lost so that the result of the second operation will be that after having scraped a *talon* of 6 inches or 1 foot in length, it will have spoilt at the same time a portion of the work turned out by the first machine by taking away the fibres already extracted by it, because they were not long enough to be secured in the hook. But in the new process I have described, this defect is remedied to a great extent, and the chief improvement in it is the doing away with the *casse-tete*. It is original in this way, *viz.*, that the *talon* of the leaf is scraped before the *point*. The *servante* is considerably used in the improved system ; its regulation, the new form that has been given to it, the new materials with which it is made, constitute as many improvements in the manner of presenting the leaf of the apparatus and contribute to increase its yield.

It is generally admitted that the leaves of aloes give an average yield of 2 per cent, that is to say, not 2lb. of fibre for 100lbs. of leaves, but 2 lb. of fibre for 100 leaves. But since the recent improvements the same leaf gives a minimum yield of 3 per cent, or often more, without increased expenditure, but on the contrary with infinitely less propelling power. The following is the result of experiments made at " Palmyra " with the new apparatus :—

Firstly.—Fifty leaves of average size, 4 feet long, weighing 56 lbs., propuced lbs. 1·75 of dry fibres, or lbs. 3·50 per 100 leaves, or lb 3·12 per 100lbs.

Secondly.—Five leaves of malgache aloes, 7 feet long, weighing 24 lb., produced lb. 0·49, or lb. 9·80 per 100 leaves, or lb. 2·03 per 100 lb.

At Mount " Choisy," in the apparatus of Mr. Cazotet, 25 leaves, weighing 42 lbs., produced lbs. 1·28 of dry fibre, or lbs. 5·12 per 100 leaves, or lbs. 3·05 per 100 lbs. The present average realized by Mr. Cazotet with the new apparatus is 3½ to 3¼ lbs. per 100 leaves. In other places they have realised up to 4·16 lbs. per 100 leaves on a week's average work. These figures are much above those realized hitherto, since they represent an average of from 3 to 3½ lbs. of dry fibre per 100 leaves, whilst with the old apparatuses the result was hardly 2 per cent.

Dr. J. Forbes Royle, in his work entitled " The fibrous plants of India suitable for cordage, clothing, and paper," says :— The *Agave* (aloe), a native of America, has become so naturalized as to appear to be indigenous in Africa, in India, and the South of Spain. The Agave plants, to which the name of American aloes is so frequently applied, resemble the true aloes in their sword-shaped leaves with parallel veins, which however grow to a gigantic size—that is, from 8 to 10 feet in length—in a cluster from the root with their margins usually armed with short thorns and their points with a hard thorn. This makes these plants so

useful in the construction of hedges and enclosures—a use to which they are applied in Italy and Sicily. The plants come to perfection in about 3 years, though they do not flower for 8, and sometimes perhaps not for 20 years, when they throw up a flower-like stalk. It is the leaves of these plants which abound in fibres of great length and of considerable strength. Being also tough and durable, they are separated for the purpose of making string and rope found to be of great value. The juice which flows from them is sometimes substituted for soap. The fibres of these *Agaves* [illegible] converted into cordage in Mexico, and this cordage is oft[illegible] in mines and on boardship.

Humboldt gives a description of the bridge on the river "Chambo" at "Quito" about 131 feet long, the principal ropes of which, about 4 inches in diameter, were made from aloe fibres. It is said that in the West Indies the Negroes make ropes, fishing nets, and hammocks out of the aloe fibres. The preparation is as follows:—At first the longest leaves of the plant are cut, and afterwards are scraped with an iron bar which is held by both hands until the whole of the juice and the pulp are removed, and there remains only the thread. Stedmann says that the fibre is like silk, and that ropes made from it are considered in England as good as any other, but that they rot more easily in water.

In Portugal this fibre is called "threads of Pita," and is used for various purposes. In Spain it is called "Pita," and, as the plant is abundant in that country, it serves for making ropes of all sizes on a large scale.

According to Dr. Balfour, in Sicily, the fibre is called "Zambaroune," and serves to make ropes and mats, and in South America the fibre of "pita" is much used for making ropes of large sizes.

The fibre and rope of *pita* are articles of commerce in the south of Spain. Mr. Roman de la Sagra recommends the introduction of some new spcies from Guatemala and Columbia, where they are known as "Cabulla" and "Coraiza." These are species of "fourcroya" which produce excellent fibres. The "fourcroya gigantea" is common at St. Helena, and has been introduced into Madras. The island of Madeira sent fibres of "pita" to the Exhibition of 1851. Mexico also sent thread and paper made from the American aloe.

The name of "pita" seems to have been given also to similar fibres obtained from Bromelia and Yucca. Dr. Hamilton says that this fibre weighs less than hemp by one-sixth. He considers it more resisting and durable than hemp and prefers it for cables, fishing nets, &c., on account of its resistance to damp. In an experiment made on board her Majesty's Ship *Portland*, a log line 300 feet in length and made of fibre of "pita" shrank 16 feet only, whilst a hemp line of the same length shrank 21 feet. Besides, the contraction of the "pita" ceased on the third day, whilst that of the hemp rope continued to shrink.

Labillardière relates that at Amboyna the aborigines obtained from the hybrid aloe, commonly called *Agave bivipara*, a long and handsome fibre equal to that of our best hemp. The aloe grows well in the north of Africa, and the French, since their occupation of Algeria, pay great attention to it. The result of some experiments made in Paris shows that the aloe rope from Algeria will bear a weight of 2,000 kilogrammes (about 4,480lb.), whilst Manilla hemp of the same thickness will not bear more than 400 kilogrammes. At Toulon fibres were steeped in sea water for six months, after which the aloe bore a weight of lbs. 3,810, whilst hemp only bore 2,538, leaving a difference of lbs. 1,272 in favor of the former.* Lastly, according to experiments made by Mr. Hornsby and reported to the Society of Agriculture of India, aloe ropes have always been found superior, not only on account of their resistance, but also on account of durability, to ropes of other kinds, such as jute, Manilla hemp, abaca, &c. The chapter ends with these almost prophetic words:—

"The fibre is sufficiently good to furnish an article of commerce of the first order, and is destined to acquire in the future a considerable value, especially since the prejudice against white cordage seems to be disappearing. It is to be hoped that important experiments will be undertaken to ascertain what are the best conditions in which the leaf should be cut, and also whether it is not possible to extract the fibre by mechanical means. Care should also be taken, when preparing the ropes, not to cut the fibres when turning them; this is a delicate operation which should be entrusted to professional rope-makers.

"The aloe grows where nothing else will grow, without cultivation, without expense. No injury whatever can be done to it either by drought, inundations, cyclones, or any of the innumerable evils which often prejudicially affect the cultivation of ordinary crops."

As already explained above, the aloe produces at present, in fibre, an average of about 3 per cent of its weight, whilst with the old apparatus 2 per cent was hardly realised. The fibre of aloes packed in bales was sold some time back in the London market at an average price of from £30 to £32 per ton, but recent accounts show sales at £38 and £40, or an advance in price of £8 to £10 per ton. These figures prove great stability in the price of the article, and are explained by the following extract from Dr. Forbes Royle's work already mentioned above:—

"It has often been said that the only means of knowing the value of fibre or of any other produce is the price which it realises in [illegible]. This is very true as regards known articles, but, if a new produce be sent to a market, few persons will buy it, because it requires new machines. I have been told that many years must elapse before a new article can draw the attention of purchasers; this is likely, for it is one of the laws of commerce."

As regards planting, much need not be said. The aloe may be planted in all seasons, and from saplings of one year, or two, or even three years old. It is best however to plant from seed. The older the aloes are when transplanted, the sooner the stem is formed. Aloes planted from seed or from saplings of the first year take five years to attain their full development, whilst, if transplanted at a height of from 18 to 20 inches, they are fully developed in three years.

In the Mauritius may be seen growing spontaneously the following species of aloes:—

(1) "Agave Americana" (American or blue aloes).
(2) "Agave Angustifolia" (aloes with small leaves).
(3) "Fourcroya Gigantea" (green aloes).
(4) "Fourcroya Gigantea, Var" (cabbage or Malgache aloes).

The species known in the Mauritius as green aloe came originally from South America and the Antilles.

RUST AND MILDEW.

READ the following letter from W. WILSON, M.A., Director of Revenue Settlement and Agriculture, Madras, to the Secretary to Government, Revenue Department, dated 5th May 1883, No. 540.

I have the honor to submit, for the consideration of Government, remarks on rust and mildew received from the Agricultural Reporter * and Mr. Benson,† Special Assistant to the Collector of the Nilgiris, to whom and to Mr. Cox, Deputy Director of Revenue Settlement, G. O., No. 327, dated 5th March 1883, was referred for report.

* Letter No. 570, dated 6th April 1883.

† Letter No. 192-85, dated 20th April 1883, in original, to be returned.

2. Messrs. Benson and Cox seem to have thought the scope of the inquiry confined to wheat, but I do not understand this to have been the intention of the Government of India. Wheat is grown but to a small extent in this Presidency, and the common cereals of the country would, it is believed, be found to be quite as subject to attack by rust when the conditions are favourable as wheat is. Mr. Cox has sent no report as owing to wheat not being grown in the part of the country where he is now working, he had no opportunity of learning anything about "wheat mildew." The area of wheat in this Presidency according to the returns for the latest available year, 1881-82, was only acres 27,758 distributed among twelve districts as marginally noted. Mustard was grown on 2,847 acres in eight districts, but in only four of them—Bellary, Godavari, Salem and Kistna—were wheat and mustard grown in the same district: there is no information as to whether they were grown in the same fields, and no information so far as inquiry has gone as to whether, when rust attacks cereals, the attack is worse when mustard is grown in the same fields. The barberry is not found in the plains, but General Morgan, whose note on the subject is enclosed in Mr. Benson's report, scouts the idea that rust in Nilgiri wheat has any connexion with the barberry, several varieties of which are very common on the hills and in the immediate vicinity of fields the wheat on which is free from rust. This alone would not disprove the connexion, contended for by Mr. Carruthers, for the necessary conditions for the germination of the spores may not have been present in the instances referred to. The conditions necessary to rust on the Nilgiris, as described by Mr. Benson and General Morgan, are similar to those under which it appears in England—continued damp and moisture: "the only check to rust," Mr. Carruthers says, "is a bright sun and a warm dry atmosphere."

Wheat.

Districts.		Area. Acres.
Kurnool	...	6,029
Nellore	...	3,999
Kristna	...	3,875
Nilgiris	...	3,8[illegible]5
Bellary	...	3,660
Coimbatore	..	2,842
Anantapur	...	1,680
Cuddapah	...	1,502
Salem	...	157
Madura	...	126
North Arcot	...	27
Godavari	...	7
Total	...	27,758

Mustard.

Districts.		Area. Acres.
Ganjam ...	...	983
Bellary ...	...	792
Godavari	...	578
South Arcot	...	236
Salem ...	...	199
Kistna ...	...	29
Vizagapatam	...	23
Malabar ...	..	7
Total	...	2,847

3. The Agricultural Reporter on the other hand states his experience in India to be that rust and other fungoid diseases are invariably the result of a sudden *drought* following a fine growing season, and that the best cure is the "restoration of the conditions of luxuriant growth," in other words, a good downpour of rain or artificial irrigation freely applied. This is altogether opposed to the views of Mr. Carruthers, according to which rust is quite dormant in drought, and is possible only when the fungoid spores can obtain a sufficient supply of moisture to enable them to germinate.

4. As a preventive, General Morgan suggests the saturation of the seeds for four-and-twenty hours before sowing in a solution of the sulphate of iron: Mr. Robertson states that saturation in a solution of the sulphate of copper has prevented "smut" at the farm, but has had no effect in preventing "rust."

5. I have in conclusion to make the following general remarks:—On the supposition that the conditions favorable to rust are in India similar to those described by Mr. Carruthers for England, *viz.*, a continuance of cold damp weather, it would appear that the crops in this Presidency can but seldom suffer seriously from it. "A few bright sunny days arrest the progress of the fungus, and vigorous plants overcome the attack without any real injury." We are never here very long without "bright sunny days," and the only crops that on *à priori* considerations might be expected to be attacked with rust are those which are sown after the first burst of the S. W. Monsoon, and they would suffer seriously only if the monsoon were unusually protracted, and

unrelieved by frequent intervals of bright sunny days, an event which we have not often to deplore.

ENCLOSURES.

Letter from W. R. ROBERTSON, Esq., M.R.A.C., Agricultural Reporter to the Government of Madras, to the Director of Revenue Settlement and Agriculture, Madras, No. 570, dated Saidapet, 6th April 1883.

I have the honor to reply to paragraph 2 of the Government of India's Circular, No. 11-A of the 19th February last.

2. Wheat is grown on a very limited area of land in this Presidency. Our cropped area varies from 22 to 25 million acres, yet we seldom, in any single year, have more than 30,000 acres under wheat. The variety of wheat generally grown is spelt *Triticum spelta*, the husk of which adheres to the grain. Ordinary wheat, *Triticum sativa*, is grown on a very small scale. The wheat is produced chiefly in Kurnool, Cuddapah, Kistna, Coimbatore, and the Nilgiris.

3. Mustard is almost unknown as a field crop in South India. It is grown on a small scale in Ganjam, Godavari, Nellore, and the Nilgiri districts. Except in the last-mentioned districts, I am aware of no place in South India where mustard and wheat are likely to be grown on the same land. In England, light wheat-soils, in some localities, are occasionally cropped by a catch crop of mustard, which is either cut and used as fodder, or is eaten on the land by sheep.

4. According to my experience in South India "mildew," *Puccinia graminis*, is not nearly so prevalent as "rust," *Tricobasis onbigo-vera*; though it appears to be generally admitted that the two parasites take their origin from the same spores. The majority of our unirrigated crops, and it is those that are most liable to be attacked by parasitic disease, are very short-lived, usually maturing in about 4½ months from seed-time, and probably this is the reason why the disease seldom passes beyond the "rust" stage when attacking those crops.

5. My experience is that these parasitic diseases usually show themselves when a fine growing season is suddenly stopped and followed by a drought. A sudden check in luxuriant vegetable growth is almost invariably followed by an attack of the fungoid disease—"rust." I have found at such times that a good shower of rain has restored luxuriant growth, and enabled the plant to throw off the disease; and I have seen the same result produced when the soil has, at such times, been freely irrigated. I believe that when the plant is attacked, when young, the best means to take to combat the disease will be those which restore or secure luxuriant growth.

6. We have successfully, at Saidapet, kept in check the fungoid diseases known generally as "smut" by dressing all the seed-corn with a solution of sulphate of copper; but this dressing has had no effect in preventing "rust."

Letter from R. S. BENSON, Esq., Special Assistant Collector in charge, to the Director of Revenue, Settlement, and Agriculture, Madras, No. 192-85, dated Ootacamund, 20th April 1883.

I have the honor to report the result of inquiries made by me regarding rust and mildew in wheat in this district as required by your endorsement, No. 377, dated 28th ultimo, on G. O., No. 327, dated 5th ultimo.

2. I append a memorandum on the subject kindly supplied to me by General Morgan who perhaps knows more about agriculture than any other gentleman on the Hills.

3. He thinks rust is not common here or in the plains, but says that it is sometimes found where the soil is damp and stiff, and if the weather is wet and cloudy. He considers that neither mustard nor the wild barberry have anything to do with the disease. He says it may be prevented by pickling the seed-grain in a solution of sulphate of iron, a remedy found effectual also in the case of coffee-leaf disease; and adds (in opposition to Mr. Carruthers) that it is more common with some kinds of wheat than with others.

4. According to inquiries made from native cultivators it seems that—

(1) Damp weather and damp soils are conditions precedent to rust in every case and that the disease is much more common than General Morgan believes. They call it "Sarvamari noyi."

(2) Rust has not been observed to be more common in wheat grown near Mustard or the Barberry, of which latter two kinds are very common on the Hills—(*a*) the *Berberis Leschenaulti* or Nilgiri holly which grows on the edges of the evergreen sholahs, and (*b*) *Berberis Asiatica*, very common all over the district in the neighbourhood of cultivation.

(3) The affected grain is covered with a grey ash-like appearance, and when squeezed, is said to leave on the hand a gummy white deposit "like the blood of worms."

(4) Some say that the ashes of cow-dung sprinkled over the grain is said to be efficacious in checking disease; others, however, know of no remedy.

5. I regret, owing to the receipt of your reminder on the 10th instant or days after receipt of the original order, I have not been able to make more extensive or satisfactory inquiries into this somewhat abstruse subject.

Memorandum from Major-General R. H. MORGAN, Ootacamund, 4th April 1883.

1. Some kinds of wheat rust more than others.

2. To prevent rust, pickle the wheat seed for 24 hours before sowing; one of the best pickles is a sulphate of iron solution.

3. The cause of rust is generally an undrained stiff clay soil, coupled with damp and cloudy weather.

4. There is but little rust in wheat on these hills or in the low country as far as I have seen.

5. I should say, so far as my experience goes, that mustard has no more to do with rust than has the barberry.

6. Rust is not only in the straw but in the grain: hence the necessity of soaking the grain in a strong pickle.

7. The coffee-leaf disease has also been propagated by seed. The only to way to destroy the fungus is to soak the seed in a pickle.

8. Barberry bushes are very common in the vicinity of Burgher fields, but I have not noticed rust in the wheat.

SELECTIONS.

AGRICULTURAL SCHOOLS IN THE WESTERN TROPICS.

THE consideration we have of late given to the encouragement of new industries in the colony has, in a measure, been the means of directing our attention to the necessity of establishing a School of Agriculture. There is little good in telling even the more intelligent of the small landowners and labourers that they can, by cultivating the many and various products this colony is blessed with, make for themselves and their children, not only an easy livelihood, but an ever-increasing source of wealth and comfort. The fruits they know and understand, which grow, we may say spontaneously, requiring but little care and attention, they will, no doubt—a suitable market offering—cultivate and attend to in the manner their forefathers did before them. But we all know what an unsatisfactory system this has been. No care taken in the collection of plants, no attempt made, by grafting or otherwise, to improve those already known to all, and no trial given to new varieties. As were the fruits of British Guiana—with the exception of a few plants got from India, Jamaica, and Trinidad, by the proprietors of one or two sugar estates—so are they still, and with this serious drawback—the natural deterioration due to old and worn out trees, and continuously planting from the same class of seeds. The consequence is, our oranges are stringy, our limes are reduced to a size not much bigger than a walnut, and other plants have degenerated in like proportions. In fact, it is the unanimous verdict of all old colonists that none of the fruits of the colony have one-half of the excellence they possessed in their younger days. The reason for this is not far to seek. The cultivators, few though these be, know nothing of the good results to be obtained from grafting or from change of seed, and have accordingly been satisfied to go along in the old grooves.

An ounce of example is worth many pounds of precept, and fortunately for the colony and its future well-being, that example can now be obtained. In the Botanical Gardens, under the able administration of Mr. Jenman and his co-adjutor, Mr. Waby, colonists have an opportunity afforded them of witnessing the results that can be procured from scientific cultivation. The difficulty that presents itself to our mind, however, is that due advantage will not be taken of the opportunities thus afforded them, by farmers and small landowners, who would more particularly benefit from the study of the work in the gardens. It is hard to move them off the beaten track, and we fear the gardens to them will only be a name. Were a School of Agriculture associated with them this would not long remain so. Our creoles, no matter of what colour or race, are not wanting in cuteness or adaptability; and parents, aware of the good they would derive from their children attending such a school as that indicated, would, we feel certain, gladly send their larger boys there. The example which would be set them of continuous industry, and the knowledge they would obtain of plant life—its conditions and proper mode of treatment—could not but have the very best effect on the agriculture of the colony. That this is true has already been shown by the advancement which has, within the last few years, been made by several of the villages in cane cultivation. The fields cultivated there are, in the great majority of instances, quite as well tilled and maintained—the item of manure only excepted—as any on the best sugar estates, and the return per acre has been good accordingly. Here we have a notable instance of the force of example, and it is but a natural deduction to add that, given a like pattern, like results would follow in other directions.

The Botanical Gardens are being, presumably, formed for the agricultural development of the colony, and for its ultimate benefit. Before they are completed three or four hundred thousand dollars will have been expended on them, and from what we have seen we have no doubt that amount will have been spent judiciously. But when we consider the intelligence of the vast majority of the taxpayers who have contributed unmurmuringly to this large outlay, we are inclined to ask *cui bono*? Only a few hundred of the inhabitants are intelligent enough to take advantage of lessons being taught them, or to appreciate the results to be derived from them. Without an Agricultural School in connection with the gardens, the colony, taken as a whole, will for many many years to come derive no recompense from the expenditure. But given the school—the pupils, we maintain, would shortly be forthcoming—their benefits would be open to all, and the lessons they are meant to teach would be, in a few years' time, spread through the length and breadth of the colony. Large reductions have this year been made in the estimates for education, and this because the Governor and members of the Combined Court considered there was no adequate

result being obtained for the money expended. In this we have no doubt they were right. In a purely agricultural colony such as this is, we want the children to grow up to be useful members of the community, and this is the end that should be aimed at in their early training. Our children must be taught that all cannot be "preachers, teachers, or stump orators." Agriculture is our sole maintenance, and the teaching given to the children should be such as would contribute to its advancement. The establishment of an Agricultural School would gradually have the way to this desirable end, and to no better purpose could a portion of the savings which has been effected in our educational system be devoted, than in founding a public school for instruction in purely Agricultural affairs.

The thousands of people who visited the Botanic Gardens yesterday afternoon were struck with the vast improvement which has lately been effected in their appearance, and the more intelligent amongst them were keenly alive to the value of work which had been, and was being, done; and showed an eager inquisitiveness as to the names and nature of the various plants. The warm interest they took in these simply shows that the plan we urged a few months ago, of establishing an Agricultural School in connection with the Garden, would be a perfect success; and its benefits would be highly appreciated by the better-to-do portion of the working classes. In many of the purely agricultural dependencies of the British Crown, these schools are already successfully established, and we can see no reason why, if the idea was properly taken up by the Government, a like success should not attend their establishment here. In Jamaica, for instance, quoting from Mr. Morris's report, referred to last week, although an actual School of Agriculture has not been established, still a system of employing cadets, and apprentices, under the trained managers and superintendents of the Government plantations has been begun, and with the happiest results. He reports that the cadets, who are received without salary for the purpose of being taught the details of the cinchona cultivation, and with the view of fitting them either to open plantations on their own account, or to act as managers of cinchona plantations, are "devoting themselves with zeal and energy to their work, and taking a keen interest in all that concerns the value and management of labor; details of nursery work; the minutiæ of planting; and the various methods adopted for successfully harvesting cinchona bark. The knowledge and experience thus gained will doubtless prove of great service to them in after-life, and I look forward to a great impetus being given to cinchona planting by the introduction of men of capital and education, who intend to devote themselves to this important industry."

Mr. Morris is quite aware of the fact that the plantations in Jamaica are being worked for the future benefit of the island, and he knows full well that the lessons he is striving to teach by lectures and pamphlets, will be still more effectually taught by the practical training of the young. Hence the encouragement he holds out to the sons of men of some capital to attend at the plantations and learn the details of their working. But he does not restrict himself to cadets only. He is quite well aware that skilled guides also require the assistance of skilled laborers, and he has accordingly engaged a number of apprentices "in order to train the better class of native workmen in the details of nursery and propagating work connected with cinchona cultivation, where they undergo a systematic course, so as to fit them in due time to take charge of nurseries or act as foremen on private plantations. The experiment, so far, has worked satisfactorily. The apprentices for the first three months receive only a nominal rate of pay, which however is gradually increased as they become more efficient. When applications are received for men to take charge of nurseries on private plantations, the best of these are recommended." Such is the system Mr. Morris is pursuing in Jamaica, and who can doubt that it will be highly beneficial to the colony, as well as to the large class of young men it is specially designed to benefit, and who have been without the means of lucrative employment.

If an Agricultural School is ever to be started in the colony, now is the time to commence it. A large portion of the Botanic Gardens is still unreclaimed, and the lessons taught to students there now are much more valuable than these would be when the gardens are completed, and initiatory work finished. The cultivation of the smaller industries which the gardens are specially designed to encourage must first be undertaken on land in much the same condition, *viz.*, undrained and abandoned. To put these in a fit state for the reception of young plants must be important work, requiring special knowledge, and that could never be better explained than by the practical illustrations the boys or others would now receive at the hands of Mr. Jenman. In Canada, Australia, some parts of India, Ceylon, &c., these schools under thoroughly practical trainers are doing a great deal of good. It seems rather an anomaly here, when compared with other colonies, that the only section of the community being deliberately trained to agricultural pursuits are those juveniles who qualify themselves by some grave offence against the law for a lengthened period of confinement and teaching at the industrial school at Onderneeming. In some respects, therefore, the lot of these is preferable to the law-abiding boys who do nothing but play marbles, or fly kites until they reach man's estates. This subject is an important one, and well worthy the careful consideration of all parties.—*Royal Gazette*, British Guiana.

DR. AITKEN ON TURNIP MANURES.

DR. AITKEN, who had attended the meeting at the request of the Galawater club, delivered a lecture on "Turnip Manures." It was now 120 years since Dawson, of Frogden, introduced the turnip to this country, and its cultivation had been rapidly developed. Among its advantages were that, when once grown, it could be stored, and afforded an independent food for cattle; it enabled the land to be much better cleaned; and it obviated what was a very ruinous kind of agriculture, bare fallow. The turnip crop had, however, its disadvantages also, and these were being experienced more now than in the early period of its history even long after the turnips were sown, there was still a considerable fallow break, which only few lands could stand, as it had the effect of decreasing the organic matter in the soil, and that is an important constituent. It was also a very expensive crop, even though useful for succeeding crops of cereals, and it was becoming year after year more liable to attack from disease. Turnips were not so much needed as formerly; they were too much grown nowadays, and in many cases on land which was better suited for pasture. Still they were a very important esculent, and would continue to be so. The question they had to consider was—What is the best kind of manure for turnips? Although we had grown turnips for upwards of 100 years, the fact that we were still asking that question showed that there were conditions to be fulfilled which made it very difficult to answer. It was a wide subject, and we were far from having anything like a definite idea of a special manure for a certain crop, a great deal depending on the soil and climate, by which the character of the manure was determined. It was thought that if the crop were analyzed, and its constituents ascertained, they would then arrive at the best manure for turnips; but that was a most erroneous idea. If they analyzed the turnip ash, it would give a great deal of sulphuric acid, an extraordinary amount of potash, much nitrogen, and comparatively little phosphoric acid. The plant assimilated most easily that which there was an abundance of, but what was wanted was to enable it to take up that which it had most difficulty in doing. He found manures being put forward in the market for turnips, whose great recommendation was that they contained a large amount of sulphuric acid. That was a case in point, where manufacturers were working on a wrong principle, and were putting into the manure that which the plant required least. To grow turnips properly they must, in the first place, have suitable land, which should be free, porous, warm, deep, and strong—not stiff, and the situation should not be too steep. They had next to consider the available nourishment in the soil, which would depend on the manner in which it had been cultivated and manured. Farmyard manure was very rich in potash, and poor in phosphorus and nitrogen: while bones were rich in phosphates, poor in nitrogen, and contained almost no potash. In the case of turnips on land to which farm-yard manure was applied, the probability was that no potash would be required, as there was plenty in the manure; but if bones were being used, the addition of potash would in all probability increase the crop. The system of cultivating the turnip was very severe on the young plant. The seed was sown so thick that it had to struggle with its neighbour for existence; and in the process of thinning and hoeing, its roots were further interfered with, the only roots left in undisturbed possession of their original ground being those which had grown straight down into the soil. They had next to consider the kind of tillage, and they must not apply manures if they were easily washed away. Turnips grow for a period of six or eight months, so that they must be guided by the consideration that they may apply manures which will take some time to dissolve, but which the plants are sure to get later on. They had learned a good deal about turnips through the experiments carried on under the Highland and Agricultural Society. Phosphoric acid in some form was most essential. It was the constituent whose want was first felt in the ground, for almost all the other crops of the farm carried off phosphates largely, leaving very little behind for the turnip. Although there was great diversity of opinion as to the best form of phosphates to apply, dissolved phosphates were, as a rule, quickest and surest; but as the turnip took a long time to grow, it was able to make use of insoluble phosphates better than other plants of quicker growth, and certain kinds of land were specially suited for these phosphates. Moorland, or land rich in organic matter, possessed the conditions for dissolving phosphates, and on such lands insoluble phosphates were found very beneficial to the turnip crop. On clay land, on the other hand, insoluble phosphates had proved a failure, and superphosphate was there required. One peculiarity brought out by the Highland Society's experiments was that superphosphate produced a larger, evener, and riper crop than insoluble phosphates. The insoluble phosphates supplied in the market varied so much that one could never be sure of getting the best kind, but with superphosphate there was greater security. All kinds of the latter were of equal value to the farmer, no matter what their source might have been. Nitrogen also existed in several forms, but the most soluble was nitrate of soda, which was a rich and powerful manure. It required to be used with great caution, being easily lost, and it was wasteful to apply it before the plants were present to receive it. There were other nitrogenous manures, however, which could be applied as soon as desired, such as bones, which took a long time to decompose. Dried blood was another form of nitrogenous manure which was very rich, and it would lie for a month of two before being useful to the plant. Putting in a slowly dissolving manure along with the seed, meant that the plant would not get it until it had arrived at a certain stage of maturity, but it was necessary to apply also some more quickly-acting manure such as nitrate of soda. Potash, when applied to turnips along with farmyard manure, so far from having done the crop good, had actually done it harm; but when applied with bones it did good. He was therefore in favour of withholding potash from the turnip manure, and applying it for the cereal crops after the root crop

is off the ground. All kinds of compost were excellent preparations for the turnip, not so much for the sake of the actual food which the turnip required, but because they prepared the land for the delicate roots of the plant. There was not much doubt that a good crop of turnips could be grown from farmyard manure; but a more reasonable question to ask was if such a valuable manure was used to the farmer's best advantage in applying it to turnips? Perhaps the best way of economizing farmyard manure was to put it first on grass, so that its valuable nitrogenous constituents might not be lost, and then to spread on the fallow. Feeding stock on the land was, perhaps, the most economical and thorough method of treating the land, so as to improve its heart and texture, but some might think it rather slow. In concluding, Dr. Aitken said the average turnip manure contained 20 per cent of soluble superphosphate, 10 per cent insoluble, 3 per cent ammonia, and, perhaps, potash also. The farmer could, however, determine his special wants by a very simple experiment. Having ascertained the relative need of his soil for phosphates, ammonia, and potash respectively, he could easily satisfy himself in what form each of those three constituents was most advantageously applied. He intended this year carrying on a set of experiments as before, but with a seven-plot instead of a five-plot test. Plot No. 1 will be manured with phosphates; No. 2, phosphates and potash; No. 3, phosphates, potash, and ammonia; No. 4, ammonia and potash; No. 5, ammonia only; No. 6, phosphates and ammonia; and No. 7 will get nothing. He had prepared schedules with instructions, and he would be glad to supply them to any one who would be willing to make the experiment, which could be done at almost no cost. He thought the Galawater Club should make a fresh start in that direction.

CULTIVATION OF THE POPPY IN ROUMELIA.

H. M. CONSUL at Salonica mentions in his last report that there are few industries in European Turkey, certainly none in Roumelia, that have been so successfully introduced and prosecuted as the cultivation of the poppy. The first attempt to grow the plant in the province of Roumelia was made about seventeen years ago, by a Turkish farmer at Istip, with a handful of the poppy seed, which he had brought from Kara-hissar, in Asia Minor; the experiment proved a complete success, and was renewed on a larger scale in the following year, 1866, since which the production of opium has annually increased and flourished in Istip, and the adjoining districts of Radovitz, Kotchan, Stroumnitza, Tikvish, and Kinprulu-Veles. The Roumelian opium, especially that produced in the district of Istip, is very pure, and contains about 11 per cent of morphia, while that of Smyrna contains scarcely 9 per cent, and is considered equal to the Malatia produce. In the year 1882, the production of the province amounted to about 135,000lbs. of opium and 5,600,000lbs. of poppy seed, most of the drug being exported to England, and about 4,000,000lbs. of the seed being exported from Salonica chiefly to Germany and France. The Turkish Government, with a view to encourage the development of this industry, remits the tithes on opium and poppy seed for one year, in the case of lands that are sown for the first time with poppy seed, and distributes in the agricultural districts printed instruction on the process of cultivating the poppy, and extracting and preparing the drug from the juice. It appears from these instructions that the *khash-kash*, or poppy seed, is sown from the month of September up to March, in localities where there is no hoar frost in spring autumn but in places where there is hoar frost, the seed must be sown in the month of September, and in the spring, after the chilly weather is passed. The soil selected is generally light, rich, and yielding; if the seed is sown in cold, clayey soil, or in damp localities, the yield will be small, and the opium of an inferior quality. The ground is always well manured, and experience has proved that if a field which has just yielded a crop of opium be immediately sown with wheat, the crop resulting from this last sowing will be remarkably good. The soil of a field to be sown with poppy seed is ploughed two or three times, and well broken up. The seed is then scattered about with the hand; after this, the soil is again thoroughly stirred up and mixed by a rake, or a row of bushes bound on to the back of a harrow. As soon as the young poppy plants begin to appear above the surface of the soil, and to bear three or four leaves, in places where they are too close together they are taken up, and planted again in such a manner as to have a space of a span between each plant, and the soil hoed two or three times to remove any weeds that may appear. Opium being a substance which is extracted from the pods or outer shells of the poppies, as soon as these pods become green in colour, and have reached their full growth, the green hue changes to yellow. A few days before this change of colour takes place, there forms over the pods a thin watery film of a light green hue; this film is called *cougak*. If it be wiped away with the finger its place still remains visible, and if at this time the pod be squeezed between the finger and thumb, it becomes so far strengthened that it cannot be easily crushed. It is at this time that the juice which forms the opium is gathered. In order to gather the juice or paste, an incision is made in the pod, beginning from the middle and going round the edges, at the same time leaving a space of about a finger's breadth, with a knife made expressly for the purpose, being small and sharp-pointed. Immediately this cut is made, there appears a white milky fluid of a bitter taste. This fluid gradually increases in consistency, and its colour becomes darker, until, in twenty-four hours, it is coffee-coloured, and as thick as paste. This is scraped off with the edge of a somewhat large and blunt knife, and put into a poppy leaf, and this is done until about twenty or thirty drachms of opium have been collected on one leaf, the edges of which are then turned in so as to prevent it being spilled. If while the opium is being collected, the film be mixed with it, it has a beneficial effect. The work of cutting lines in the pods of the poppies is generally commenced early in the afternoon, and continued until nightfall. As the opium must be collected twenty-four hours after this operation has been concluded, the labourers commence on the following day, soon after twelve o'clock, to collect the opium from the pods which were cut the day before, and also to make incisions in other pods. Any pods which are not quite ripe, are left until they become thoroughly ripe and fit for cutting. In order that the exact season for collecting the juice may not be missed, the whole work must be performed in eight or ten days, and the proper time for marking the pods must be accurately ascertained, for if the pods be cut before or after they are quite ripe, there is no yield of opium. Great care is taken not to cut the pods while a high wind is blowing, or when it is raining, as in the latter case the rain washes away and destroys the juice as fast as it exudes from the seams that have been cut for it. After the opium crop has been gathered in, the pods change their previous hue, of either green or yellow, to rose colour; when this change takes place, the plants are taken up by the roots, one by one, and collected in small bundles. Each bundle is then bound by a young green withe, and so placed upright in the ground that the roots of the plants are covered, in which position they remain for a few days, until the seed contained in the pods becomes thoroughly dried and matured. The pods are then threshed with a stick until they break open, when the seed is collected. Another method which is often employed, is to sever the stem of the plant at the knot which is found close up to the pod with the finger and thumb, and after collecting the ends so severed, to spread them out to dry in some open place, and then to break them open by threshing, or else to pull them to pieces, and after sifting the seed until it is quite free from extraneous matter, to collect it. At Kara-hissar, most of the pods are burned to reduce them to ashes, and a fluid is extracted from them, which is used to bleach cotton, as it is considered more effective than the water which is strained off from ordinary ashes. After extracting the oil from the poppy seed, there remains a sediment technically called *kynsobe*, on which buffaloes, cows, and black kine generally, are fed, on the ground that such diet increases the amount of milk given.—*Journal of the Society of Arts.*

TIMBER FOR TEA BOXES.

ONE of the great benefits which railway extension, when completed, will confer on the rising tea industry of Ceylon, will be that of placing suitable timber, cheap, while sufficiently durable, at the disposal of planters. Boxes of proper sizes can be transported in shooks, the parts so prepared that only putting together, hooping and nailing, will be required. An establishment purchasing, seasoning and working up large quantities of cheap timber ought, it appears to us, even now to be able to supply boxes in shooks, which after bearing railway, cart and cooly carriage, would be cheaper than those made on estates by ordinary carpenters. In any case such boxes ought to be less liable to warp, and so better suited to be easily and rapidly put together. Premising that some estates may be entirely destitute of timber, the whole question in the case of properties possessed of reserves must be one of cost: the fact being kept in mind that the market value of reserve timber ought to be approximately calculated. Wishing to have reliable data for comparison between estate-made boxes and those obtainable in Colombo, we have been making personal enquiries. In one case we found that *hal* and *mango* timbers were employed. Against the latter there is a good deal of prejudice owing to the supposed acrid quality of its juices, while *hal*, unless very carefully seasoned, would also be objectionable. The price quoted for an 80 lb. box was Rs. 1·80, with 5 per cent discount for a quantity. At another establishment we were shewn some well-seasoned *lunumedilla* timber which in appearance and texture seemed all that could be desired. Our only fear was that this really nice-looking timber was open to the same objection as the white and red cedars of India, that of being too good for the purpose. For it is not part of the function of the tea planter in India or Ceylon to supply the buyer of his tea with timber which can be advantageously utilized in England, unless he is certain of a price being bid high in proportion to the value of the timber and its cost to himself. If the boxes are made of well-seasoned timber, free from corrosive juice or offensive odour, not liable to attacks of dry-rot or insects, and able for a period of four months or so to resist exposure and knocking about, that is all which can be desiderated. The price quoted for an 80lb. box of this really superior timber was Rs. 2·12, thirty-two cents, or nearly one-third of a rupee, dearer than the previous quotation. We cannot help hoping, however, that *lunumedilla* can untimately be obtained at prices which will lead to its utilization for tea boxes. It grows rapidly to a great height and sends out so few horizontal branches that a very large number of trees could be grown on an acre of land. As the tree is said to be fit for timber purposes in its tenth year, it seems obvious that plantations of this fast-growing timber-tree ought to pay well by-and-bye. Mr. W. Ferguson, with all his study of trees and their properties, is of opinion that of all the timber trees of Ceylon this is the best suited for the manufacture of tea boxes; but it is so useful for many purposes, especially of boat-building and house construction (it makes beautiful ceilings), that we fear it is too expensive to be converted into tea boxes. As there is not much spare capital in the island, and few persons who can afford to wait ten years even for a large return for their money, we commend the cultivation of this tree emphatically to the attention of the Forest

officers of Ceylon. The tree is especially a free seeder, so that hundreds of bushels of the seeds could be obtained at once. An allied tree, what in Ceylon we call popularly "the Persian lilac" (from its sweet-smelling lilac-like blossoms) has the same property of producing a large crop of seeds. We saw a specimen in Mr. James Henty's grounds at Kew, a suburb of Melbourne, and found that it was known in Australia as the "white cedar." We have never heard of its attaining the dimensions of a timber tree in Ceylon, but it ought to be more prized than it is as an ornamental dwarf-tree. Mr. Brace, who wrote an essay on tea cultivation, which was published at the *Observer* office, gave a list of a dozen and-a-half timbers which he knew or supposed would be suitable, and noticed the *lunumedilla* thus :—"Melia composita. Probably an excellent wood for this purpose. Beddome remarks :—'It is common in Ceylon, and is known by the native name of *lunumedilla*, and Mr. W. Ferguson of the island says the timber is very light and cedar-like, and in use for outriggers of boats and ceilings, and that it is said whiteants will not attack it. This probably might take the place of our cedars, not only for boxes, but for most of the items of furniture needed on an estate.'" Mr. W. Ferguson now writes :—

Hal is so inferior and so full of resin that it is only used for *coffins*. *Mango* wood is considered an inferior wood, but has been a good deal used for coffee casks.

The *lunumedilla* is no doubt about the best tree and timber for tea-boxes in every respect in Ceylon. It is of very rapid growth, is still an abundant tree in the island, easily procurable, being floated down the rivers. It is used for the outriggers of Ceylon canoes; for kattumarams; is the best Ceylon wood for ceilings because it has a slight look of mahogany and can be varnished or polished, and is said not to be attacked by whiteants; is very light but not strong, seasons very rapidly. It was described under several botanical names and generally as the *Melia composita* of Willdenow, but Mr. P. Hiern, who has worked out this order in Flora Brit. Ind. 1, p. 545, restores its first or oldest name, *Melia dubia*, Cavanilles, and gives the following synonyms for it :—M. superba, Rox., M. robusta, Rox., M. australasica, Adr. Juss., M. æthiopica, Welw., M. Bombolo, Welw.,—and M. argentea, Hb. Ham. I feel sure that it is also the Auletæa Javanica, Gaert. 1,277, t. 58, f. 2.

Seeds about the size of an olive, and very like them; can be had in abundance in their season. Tree very high, leaves tripinnate very large, on tops of branches, not a good shade tree, because it is quite leafless at times.

I saw an advertisement in the *Observer* from the Madras Railway or Harbour Department some months ago, calling for tenders for a supply of this wood, as *Malay Vambu*, if I recollect aright.

Mr. W. Ferguson and others will, however, like ourselves, have to review their opinions in regard to *hal*, in the presence of a specimen box of this wood sent to us by the manager of the Ceylon Company, Limited. This Company has had its experience of bad as well as good woods, and the final conclusion is in favour of good, well-seasoned *hal* for tea-boxes. This was intimated to us in answer to a letter of enquiry whether materials for tea-boxes procured and prepared in quantity could not be sold at a price cheaper than the cost of boxes in many cases made on estates. Copy of a circular was sent to us, in which we were told we should find our suggestions anticipated. In this circular, amongst information in regard to the leading requisites for packing tea, we find the following :—

TEA CHESTS.—The company have a large stock of throroughly seasoned *hal* wood cut up for chests, only requiring to be put together.—The chests are dovetailed, and their outside measurement is 24 in. by 19 by 19 in., so that ten chests make exactly 1 ton of 50 feet cubic measurement.

They hold 85 lb. Pekoe Souchong,
90 lb. pekoe,
110 lb. Broken Pekoe,

and can be supplied in shooks delivered at the Colombo Railway Station at Rs. 1·30 each (without nails), or made up (with nails) at Rs. 1·40 each.

A chest requires about 70 to 80 wire nails (1 lb. = about 380 nails.)
" " 6 lb. tea lead.
" " 3 oz. solder.
not quite ½ lb. hoop iron.
about 70 rose nails for fastening do. (1 lb. = about 560 nails.)

Now, provided the *hal* wood tea chest turns out to be good and serviceable,—and we can affirm that it *looks* the right thing, while the Company's Manager says the chests made of *hal* are good and compare most favourably with Indian tea boxes, of which a large number has passed through his hands, we have here a box of superior capacity at a lower price than those previously quoted (made up with nails Rs. 1·40 each) and constructed on such scientific principles as to size, that ten such boxes make up exactly the measurement ton of 50 cubic feet by which freight on tea is charged. If, in addition, the Company could manage so that each box should weigh exactly the same, so as to save the injurious necessity of bulking in the London Customs, they would deserve to be regarded as special benefactors to the tea interest of Ceylon. Perfectly seasoned wood, if not exposed to wet, ought not to alter appreciably in weight, and the weight of nails, tea lead, solder and hoop iron should be uniform. We surely are within hailing distance of the time when the quantity of tea of each kind in boxes can be so entirely relied upon, even by men so accustomed to the shady side of human nature as customs officers, that there may be no occasion to open boxes before sales, except for the purpose of taking samples.

All tea planters are grateful for having the above information placed prominently before them, the best way in which they can make a return is by supplying us, for the benefit of those interested in the new industry, with information as to the kinds of forest trees, in the low country and at high elevations, which have hitherto been found best suited for the boxes, the prevalence of such timbers, and the comparative cost at which they can be felled, sawn, seasoned, and worked up on estates. It is of much importance that the use of tea driers will save the necessity of converting some of the best timber on estates into charcoal, because such timber can now be utilized for tea boxes or other purposes. With railway extension, indeed, it is possible that coke may be found a cheaper and better fuel for the tea-dryers than firewood, the smoke from which might be objectionable. As the supply of really good timber in the hill forests of Ceylon is, after all, very scanty, information regarding the best trees to grow at various elevations will be valuable. We do not forget the lists of low and high elevation trees issued by the late Dr. Thwaites, but they were prepared without any reference to the question now being discussed. We fear the *lunumedilla* is specially a low-country plant, but probably trials will show that this and other suitable plants have a pretty extensive range as regards altitude.

Our present enquiries were started by the receipt of a letter from Mr. J. S. Gamble, whom we had the pleasure of meeting in British Sikhim in 1876, and who is now at the head of the Madras Government Forest Department. To the Indian and botanical names furnished by Mr. Gamble, Mr. W. Ferguson has, at our request, added notes indicating whether the trees are indigenous to or to be found in Ceylon. Here are the letter and the notes :—

Madras, April 3rd, 1883

SIR,—At p. 720 of your March No. of the *Tropical Agriculturist*, you take me to task for not giving the scientific names of the trees which I enumerated by their vernacular ones, as producing woods fit for tea-boxes. So I send you the list with the native names perfectly corrected as to spelling. The misprints were chiefly made by the *Indian Forester*, I see. For 'Chota Kagpur' please read 'Chota Nagpur.'

Yours,

J. S. GAMBLE.

Indian Names.		*Botanical Names.*
Toon	...	1. Cedrela Toona, microcarpa or glabra (*a*)
Lampatia	...	2. Durbanga sonneratiodes (*b*)
Semul	...	3. Bombax malabaricum (*c*)
Goguldhup	...	4. Canarium bengalense (*d*)
Kadam	...	5. Anthocaphalus Cadamba (*e*)
Mandania	...	6. Acrocarpus fraxinifolias (*f*)
Mainakat	...	7. Tetrameles nudiflora (*g*)
Udal	...	8. Sterculia villosa (bad) (*h*)
Kabashi	...	9. Acer Campbellii or lævigatum (*i*)
Mahua	...	10. Engelhardtia spicata (*j*)
Gobria	...	11. Echinocarpus dasyoarpus (*k*)
Chilauni	...	12. Nyssa sessiliflora (*l*)
Lopchaphal	...	13. Machilus edulis (*m*)
Tarsing	...	14. Beilschmiedia Roxburghiana (*n*)
Salai	...	15. Boswellia thurifera (*o*)

Mr. W. Ferguson's Notes :—(*a*) Not a native of Ceylon. Introduced in Peradeniya. (*b*) Not in Ceylon. (*c*) Katu-Imbul. Red flowered silk-cotton tree. (*d*) Not in Ceylon. (*e*) Common Ceylon tree. (*f*) Not in Ceylon. Leguminoseæ. (*g*) In Ceylon hills rare. Datiscaceæ. (*h*, *i*, and *j*) Not in Ceylon. (*k*) Not in Ceylon. Bhootan, Sikkim, Eastern Himalaya. (*l*) Sikkim 5,000—7,000 ft. Martaban, Java. (*m*) Native of Northern India. (*n*) Also Northern India. (*o*) In nothern part of Madras Presidency, and in Bengal; this and No. 4 closely allied. We have in Ceylon the Kækuna, Canarium Zeylanicum, Thwaites.

Mr. W. Ferguson adds detailed remarks as follows :—

NOTES ON MR. GAMBLE'S LIST OF TIMBER TREES FIT FOR TEA BOXES.

I have put notes opposite to Mr. Gamble's list, and I shall here refer to the Nos. only, as there is no use in repeating the native and botanic names :—

1.—Introduced to Ceylon and in the Peradeniya gardens. Same family, Meliaceæ, as the Lunumedilla.

2.—Not yet in Ceylon. D. moluccana, in the Peradeniya gardens. See Morris's list. It is of the same family as the lagerstrœmia flos-reginæ, the Murutu.

3.—The red flowered silk cotton tree. Kattu-Imbul. Wood too weak and perishable, I should think.

4.—The family that produce the aromatic gums of the Role. We have one in Ceylon, the Kækuna. C. zeylanium, Thwaites. See No. 15 of same family. I don't think the timber of these would be good for tea boxes.

5.—Ceylon tree, large, and a quick grower. I know it well, but don't know much about its timber. It is so close an ally of the Bak-mi, which injured some Ceylon Company's tea, and about which Mr. Horsfall wrote to the *Observer*, that they used to be in the same genus, Rubiaceæ.

6.—Not in Ceylon. An Indian tree. Don't know much about it. A large tree.

7.—A Ceylon tree. The only one of the order Datisceæ. I have never seen the tree, and failed to get a specimen of it.

8.—Not in Ceylon. Several of the family in Ceylon. I do not think any of them will be good for tea boxes.

9.—None of this genus in Ceylon.

10.—Not yet in Ceylon.

11.—Not in Ceylon. Allied to the Weralus. Bhootan, Sikkim, Eastern Himalaya.

12.—Not in Ceylon. An obscure family. This tree 60 feet high: Sikhim at 5,000—7,000 feet. Martaban, Java.

13.—One of the laurels. Native of Northern India. Edu-Dawulu, a famous timber tree on estates in Dimbula and elsewhere,

a close ally, but some of them are likely to have aromatic woods. The famous *Yaverni*, Ascodaphne semicarpifolia, of the Eastern Province. A good wood. Same family cinnamon, camphor, &c.

14.—Not in Ceylon. Northern India. Same family as No. 13.

15.—Not in Ceylon. In northern part of the Madras presidency and Bengal. See my note on No. 4.

See No. 13, p. 53, "Tea Cultivation in S. India and Ceylon," &c., and W. F's "Timber Trees."

As lightness combined with just sufficient strength to carry home a load of tea safely are the desiderata for tea-box timber, it is quite possible that experience may decide in favour of trees which the writer of the notes does not estimate highly. For instance, the *Bombax malabaricum*, or scarlet-flowered cotton tree. We do not know about its rapidity of growth, but such trees as this and *Erythrina indica*, and especially the common green cotton tree, could be crammed in great numbers into a limited space of ground. We do not want *valuable* timber for tea-boxes. If it is light, so much the better, provided it will season well and stand knocking about for a few months. Objectionable aroma, juices and gum, could probably be got rid of by judicious seasonings. Fire heat or steam, properly applied, can effect wonderful changes in the nature of timbers.

We add some general remarks with which Mr. W. Ferguson accompanied his notes :—

Surely by this time you and the other tea planters of Ceylon, *viz.*, Taylor, Elphinstone, Armstrong, Jones, Blackwood, Ceylon Company, Owen, and others, have found out the *cheapest* and *best* kind of boxes, native or foreign, for packing tea in, and, if made of native woods, there ought to be a list of native names—at least of those found best fitted for the work. [Details regarding the timbers used on Abbotsford will be forthcoming immediately.—ED., *C. O.*] I do not think there is any use in attempting to introduce and grow any foreign tree for this purpose, as I believe we have abundance of trees which will answer equally well.

Mr. Owen sent me a list of trees some time ago, and asked me to say which of them were suitable for tea boxes. I met him in the *Observer* office, and said : "Trust a great deal to your native carpenters, who know the qualities of the different native woods. Don't use those that have *milk, gum,* or *acrid juice, resin,* &c., in the wood. Don't use heavy wood, nor one that will perish very soon, and don't let the wood have any smell of any kind, if possible."

But I fear the great bugbear is the want of proper seasoning in the log, and after it is sawn, before it is converted into tea boxes.

There was a regular set of saw-mills at work in the forests at Awisawella some time ago sawing timber for tea boxes and other purposes, and the gentleman in charge whom I met at Mr. Ward's house at Hanwella some time ago, promised to send me a list of the good and bad trees. I made a selection of 113 of the best timber trees of Ceylon, when I made the notes to Mendis's list, but I shall now include all the *real trees* of Ceylon, and finish their uses, or wipe them out as utterly useless. How in the mean-time can we get lists from the different tea planters named, shewing the best tea woods they have actually used ?

We cannot doubt that the information desiderated will be supplied, so that ere long we may have a reliable list of the most suitable timbers for tea-boxes and all the purposes connected with the tea industry.

Meantime we quote from Mr. Brace's list :—

ACROCARPUS FRAXINIFOLIUS : RED CEDAR.—"The timber is flesh-coloured and shrinks in seasoning ; it is light and much resembles that of *cedrela toona* and has a cedrelaceous smell ; it is known to planters by the name of Shingle Tree, Pink Cedar, and Red Cedar, and is called *mullay* here in Tinnevelly, and *kilingi* by the burghers on the Neilgherries ; it is of rapid growth and well worthy of cultivation by the Forest Department" (Bedd. Flor. Sylv.). I have used this timber more perhaps than any other for tea-boxes and tea house furniture in general, and if it has been well seasoned it is as good a wood as could be procured for the purpose. I am not aware if this tree is found in Ceylon, but as it is readily propagated from seed, I could suggest its being introduced. I cannot urge on planters too strongly the advisability of planting up odd corners of their grass-lands, &c., with useful timber trees, the cost of so doing is a mere trifle, and the addition made to the value of the property, say, in ten years' time, is very great.

ALSTONIA SCHOLARIS.—"In Ceylon it is called *rookattana*, and the wood is therefore generally employed for making coffins. * * * * * This wood, which is very bitter, is white and light, and is used for making packing cases, &c." (Bedd. Flor. Sylv.)

This would probably be found an excellent wood for making boxes.

ARTOCARPUS HIRSUTUS.—"This tree yields the aujely wood so well known on the Western Coast for house building, ships, frame-works, &c. The tree attains a large size in the forests on the Western Coast, where it abounds. The fruit is the size of a large orange, and abounds in a viscid juice, which freely flows from the rind if touched ; this is manufactured into birdlime." (Drury, id.). This too is an excellent wood both for making boxes, buildings and estate furniture generally, and like its congeners as ornamental as it is useful.

ARTOCARPUS INTEGRIFOLIA.—This is perhaps the best wood for box-making of any ; and is easily propagated and of rapid growth.

Beddome remarks that this tree is only found in Ceylon. Probably the timber is very similar to that of the other varieties and might be used for the same purposes.

CEDRELA TOONA : WHITE CEDAR.—Called on the Neilgherries *kal kilingi.* Drury remarks, "The wood is dense, hard, red, close-grained, capable of high polish, not subjected to worms, nor liable to warp, and durable." Beddome says that "it is curiously absent from Ceylon." (Flor. Sylv.) This is a splendid wood, in my opinion, and as it is readily raised from seed and of rapid growth, I would strongly advise Ceylon planters to introduce it. I never use any other wood when I can procure this at a moderate rate. There is hardly a purpose to which it may not be supplied. I employ it for leaf racks, rolling tables, &c.

LITSÆA ZEYLANICA.—"This tree is most abundant on the Neilgherries at 6,000 to 7,000 feet elevation, and is found throughout our Western Ghats at elevations about 2,000 feet, and it is equally common in Ceylon where it is called *dawul kurundu.*" (Bedd. Flor. Sylv.) This is perhaps the best wood when well seasoned for boxes that one can meet with at the higher elevations, quite equal to the red and white cedars.

MACHILUS MACRANTHA.—"Called in Ceylon *ullala* ; the timber is often used for building purposes : it is light and even grained, and would answer as a substitute for deal." (Bedd. Flor. Sylv. This is probably a first-class wood for box-making.

TECTONA GRANDIS : TEAK.—Teak is an excellent wood for boxes when it has been well seasoned, and can be procured cheap. Though heavy, it can safely be sawn much thinner than other woods. I am not aware if the tree is found in Ceylon.

TERMINALIA BELLERICA.—"Found in Ceylon and there called *bulu*. It answers well for packing-cases and coffee boxes." (Bedd. Flor. Zeylan.). This would probably answer well for tea-boxes also.

It would thus appear that there are trees indigenous to Southern India, which would be valuable if they could be naturalized in Ceylon. The jack tree and the del (Artocarpus nobilis) are, of course, too valuable for tea chests. So we should say of teak, unless it could be obtained in abundance and sawn into very thin laminæ. If Mr. Brace is correct, the *dawul kurundu* ought to be found useful at high elevations. But the railway is a great leveller, even of altitudes, and the time is probably coming when nearly all tea estates will be supplied with tea-boxes from the "low country." A correspondent of the local *Timber* writes as follows :—

"The owners of tea estates would do well to begin at once the growing of suitable timber trees, as it will greatly enhance the value of their properties. Even where there is a forest reserve, it is chiefly valuable for its fuel, as the *suitable* timber trees form but a very small percentage of the forest. There are numerous kinds of indigenous fast-growing timber trees that would thrive better than the Australian gums on high estates. Jack is too heavy a wood and is not of very quick growth. Teak is as heavy, but is a harder and better timber for chests, if sawn in thin pieces, and exposed for a few months in a dry place or shed. It grows faster than jack after the first year. Hallmilla, Boramel, Suriyah (tulip tree), Catta imbul are very suitable, and are very fast growers. The tulip tree wood is little used, being scarce, as all is bought up by carriage builders. It is light, strong, pliant and suited for tea chests, being free of resin and acids, &c. On some coffee estates, where no timber trees are grown, fuel for coolies has to be bought and carted to the estates, and doled out pound by pound. This will occur on tea properties when the reserves are exhausted, or planted up, as they will be, when the old clearings look seedy. For many more reasons the early planting of timber trees is a necessity on tea estates, and they who have omitted to do so should begin at once.—*Ceylon Observer.*

WHEAT MILDEW.

(BY WILLIAM CARRUTHERS, F.R.S., *Consulting Botanist to the Royal Agricultural Society of England.*)

[Extract from the Society's Journal.]

THE minute fungi which live on other plants, and produce blights or diseases, have received special attention in recent years, because of the serious losses which they bring with them, and because of the remarkable facts in the economy of vegetable life which their study has disclosed.

The hop, the vine, the potato, and the different cereal crops are equally liable to great injury, and sometimes to destruction, from the attacks of these parasitic plants. And none is more wide-spreading in its attack, and more serious in its action, than the mildew which attacks the wheat crop in summer or autumn.

The desire to discover some means of preventing or alleviating the malady caused by mildew, has led to the frequent careful study of this plant. In the second volume of this journal (pages 11 and 220), Professor Henslow, in a paper on the diseases of wheat, gave a careful description of the mildew, and reasons for believing that rust and mildew were produced by the same fungus. He also investigated the prevalent notion that the barberry was in some way connected with the mildew, and recommended that experiments should be instituted with the view of testing the matter. He was not himself prepared to accept the opinion, though he records a case which he found it hard by any other explanation to understand. A farmer in Oxfordshire had a field which, when sown with wheat, was generally infected at one portion with mildew. This part was in the immediate neighbourhood of an old hedge, in which there were several barberry bushes. The blight did not extend farther than twenty yards from the hedge, and it was most abundant in the immediate neighbourhood of each of the somewhat widely-separated bushes. The farmer had all the barberry cut out of the hedge. He took one of the largest bushes, and placed it in the middle of the field. Before reaping he found the straw, for some yards round the bush, injured

by mildew, though not to the same extent as on the side of the field nigh to the hedge.

A later volume of the journal contains an able and lucid exposition of the parasitic fungi of the British farm, which had been delivered as a popular lecture by the R. . Edwin Sidney, and among them is included the mildew fungus.

Until the investigations of Tulasne and DeBary, nothing was added to the knowledge of the mildew beyond what was contained in these papers.

The belief held by Henslow, that rust and mildew were produced by the same fungus, was demonstrated to be the case by Tulasne, who proved that the rust was an earlier stage in the life-history of the plant which afterwards produced the mildew.

The relation between the barberry and the mildew was established still later by DeBary, who discovered that the cluster-cup or *Æcidium* on the leaf of the barberry was a still earlier state of the mildew than the rust.

That a plant might spend some stages of its life in conditions, and under a form different from its perfect state, was in harmony with obvious facts in the animal kingdom. The development of the grub living in the earth or swimming in the water, into a fly or beetle inhabiting the air, made one familiar with great changes in the life-history of an organic being. The perfect state was easily deter[mine]d, [beca]use only in that state had the animal the power of producing eggs, and so providing for the continuance of its kind. [Bu]t in [the]se parasitic fungi, each stage ended in the production of spores—that is, of bodies equivalent in function to the seeds of flowering plants or the eggs of animals, and capable of developing fresh individuals.

The structure of the fungus in the different stages of its existence as the *Æcidium* on the barberry, and the rust or mildew on the wheat, was so very different, that botanists could not entertain the notion that any organic relation existed between them, and those most intimately acquainted with these parasitic plants were most decided in their views as to the absurdity of entertaining such a notion. Especially did it appear improbable that the plant grown from a spore should have no resemblance to the parent producing the spore, but that instead it should belong to a group which the scientific student had widely separated from the parent. Within the last ten years our first authority in England wrote:

"There has been a very unjust charge brought against *Æcidium berberidis*, a beautiful species which attacks the leaves, flowers, and young fruit of the barberry as if it were the cause of mildew in wheat. Great, however, as are the changes which fungi undergo occasionally in passing from one condition to another, there is not the slightest reason for imagining that the *Æcidium* is a transitorial state of wheat mildew. It has its own mode of propagation and passes through nearly the same phases of vegetation as the mildew, without affording a suspicion that it is not a perfect plant. The whole story has no doubt arisen from the *Æcidium* being common on the barberry in hedges surrounding wheat fields; and there is reason to believe the report is true, that wheat has been especially mildewed in the neighbourhood of the *Æcidium*. The peculiar situation may, however, be equally favourable to either parasite; and it is to be observed that mildew is peculiarly prevalent in districts where the barberry is unknown except as a garden plant."

The careful investigations and experiments of DeBary, corroborated by the subsequent discovery by other botanists of similar phenomena in the life-history of other fungi than mildew of wheat, have, however, determined beyond all question that the *Æcidium* of the barberry, the rust and the mildew of wheat, are only stages in the life of the same plant, though each stage presents the phenomena we have been accustomed to consider characteristic of a perfect plant—the producing innumerable spores or seeds capable of giving rise to new individuals. DeBary has indeed produced each stage of the plant from the spores produced by the previous stage.

Let us now trace the history of the fungus through its different forms of life.

The first stage in its life, after the rest of the winter, is that which it passes on the barberry. In the spring the leaves of this plant may sometimes be found with swollen yellowish spots, which in a short time burst through the skin, and form little bordered cups filled with a reddish powder. Under this form the plant is known as *Æcidium berberidi*. The genus *Æcidium* was, till recently, believed to contain a clearly limited and natural group of species, of which nearly forty were found in Britain on the leaves or stems of the barberry, gooseberry, buttercup, anemone, spurge, nettle, &c.

That on the barberry occurs chiefly on the leaves, but sometimes attacks the leaf-stalk and the fruit. It may be detected in May or June as a bright red spot on the under-side of the leaf, which, when carefully examined, is found to be a little cup full of free, round, and very minute bodies. A still more minute examination of the leaf will show that the fungus has another form of fructification on the upper surface of the leaf, where one may detect some scarcely perceptible pustules, through the central pore of which protrude a small bunch of minute hairs. In section and under the microscope these pustules are seen to be the openings of small flask-shaped bodies filled with the delicate needle-like hairs which protrude themselves through the opening. Towards the base of the flask may be detected numerous very minute round bodies, the function of which has not yet been clearly ascertained. The larger cups opening on the lower surface of the leaf are found to be equally well defined, and to be enclosed in distinct covering. At first appearing as little spores, they increase in size until they burst through the skin, and the apex breaks in a more or less regular manner, forming a margin to the cup, which is filled with minute round bodies of a reddish colour. These are the spores from which the next stage of the plant is developed.

Both forms of fructification grow on very delicate fungal threads, called mycelium, which penetrate the leaf in every direction, and withdraw from it the food required for the life and growth of the parasite.

The quantity of spores produced in the cups on a single barberry leaf is enormous. It is impossible to realise the myriads of fungal spores which are floating in the atmosphere during the greater part of the year, ready, whenever the fitting physical conditions are present, to germinate. No place is free from their presence. They are so minute that we see them only as motes dancing in the sunbeam. But though so minute, they are mighty agents for good or for evil, because of their extraordinary quantity.

The spores of fungi are limited to some extent in their operations by the fact that each spore can germinate only on the species of plant that is proper to it. If the seed of a flowering plant be supplied with suitable heat, moisture, and air, it will germinate in any soil, and maintain a vigorous life or otherwise, in accordance with the character of the soil. But happily the spores of these fungi must not only have the necessary physical conditions required by the seed, but they will fail in establishing themselves unless they further find these conditions associated with that particular species of plant with which their life-history is associated. Were it not so, the spores produced in a single season would be more than sufficient to clothe every inch of the surface of the earth with a dense mould.

The red spores of the barberry fungus will produce a mycelium only when they germinate on the leaf or stem of wheat, or of some other grass. And they can germinate there only when they can obtain a sufficient supply of moisture.

It is a very general notion that mildew and other blights are "in the air," or are produced by fogs or mists. To some extent these notions are true. The farmer has observed the atmospheric conditions favourable to the growth of the spores, and without being aware how they quickened into life the everywhere present spores, they give the physical conditions the credit of being the efficient producers of the blight. But just as dry grain remains for any length of time in the barn without germinating, so the spores of the potato-fungus rest on the potato, or those of the barberry-fungus on the wheat without germination, if there be no free moisture accessible to them. A slight reduction of temperature, when the warm air of summer or autumn is saturated with moisture after rain, liberates some of the aqueous vapour which had formed an invisible ingredient of the atmosphere, and a mist is produced. This mist supplies the spore with the moisture it needs, and germination begins; a small tube is pushed out, and, finding its way to one of the minute openings or stomates of the leaf, it passes through into the tissues, where, finding suitable food, it rapidly grows. In a week or ten days one can detect the presence of the fungus in the wheat by linear reddish swellings on the leaf and stem. When ripe, the skin bursts, and innumerable oval red spores are exposed and dispersed.

When the suitable conditions are present, these spores germinate on wheat or on other grasses, the growing tubes pass through the stomates, produce mycelium in the cellular tissues of the leaf, and in a week, more or less, a new crop of spores bursts the skin of the plant, and is scattered in the air. Several generations of this form of the fungus may be produced in the course of a few weeks. In the older patches, and from the same mycelium, another kind of fruit is produced, at first among the red spores of the rust, and then entirely by itself when the production of the rust-spores ceases. These are the spores of the mildew. They are oblong, and taper towards each end, and are composed of two cells, the division being across the middle of the spore.

As in the rust, the delicate threads or mycelium of the mildew penetrate the cellular tissue of the leaf or stem in every direction.

The spores are produced under the skin. They form long narrow swellings of a brownish colour. When the swellings burst the skin, a mass of dark spores fills the opening. If the disease is very bad, the plant is so completely covered with the dark spores that is has the appearance of having been scorched.

The active life of the fungus closes with the production of the mildew-spores. These spores do not germinate and propagate the mildew on other wheat plants. This is done only by the spores of the rust. The mildew-spores remain on the leaves and straw throughout the winter, and show no signs of life till the spring, when, under favourable conditions, they begin to germinate. Each of the two cells of which the spore is composed sends out a short filament, that terminates in three or four branches. The tips of these branches swell, and another kind of spore is produced, after which the filament dies. These minute and delicate spores develop a mycelium only when they germinate on the leaf of the barberry. The germinating filament does not seek admission to the leaf through a stomate, but is has the power, like the spores of the fungus which causes the potato disease, of penetrating the skin where it germinates and passing directly into the tissues of the leaf. There it rapidly grows, and in a short time produces the two kinds of fructification which have been already described.

The injury done to the wheat by the rust and mildew arises from the fungus appropriating to its own use the elaborated juices of the wheat. Fungi are plants without the green colouring matter or chlorophyl, which exists in other plants, and they are consequently unable to separate the carbon from the carbonic acid gas of the air—that is, to manufacture plant-food from the raw materials on which plants live. They therefore depend on the already prepared food of the plants on which they are parasitic. The fungus in its rust-stage takes possession of the growing plant, and weakens it so far as it appropriates material which was intended to build up the growing wheat. But as the wheat at the time of the attack is very active in assimilating food, the rust rarely injures to any serious extent the crop, unless in an exceptionally wet season, when the abundance of moisture secures the germination of successive crops of spores. A few bright sunny days arrest the progress of the fungus, and vigorous plants overcome the attack without any real injury.

When, however, the mildew appears at a later stage in the leaf of the wheat, the conditions are entirely changed. The period of active assimilation of food is past. The plant has laid up stores of food in various parts of its structure, and the processes of flowering and fruiting, which use up these stores, are proceeding. The altered starch is being conveyed from the cells, where it was temporarily located, to its final destination in the seed. The fungus arrests it in its progress, and converts it to its own use. The wheat is not able to cope with the parasite as in the earlier stage of its life when the fungus was present as rust. It cannot start again the process of assimilating food, and consequently the seed is more or less imperfectly filled, in proportion to the time at which the fungus attacks the plant, and the extent of the attack.

The story of the fungus suggests important considerations to the farmer. First, it is certain that the brown spores of the mildew which remain attached to the straw after harvest, are the means by which the fungus retains its vitality through the winter Converting the straw into manure does not destroy the spores, but rather provides in the spring the conditions fitted for their germination. It may be recommending a serious destruction of property to suggest the burning of mildewed straw, but fire is the only agent that will effectually destroy the spores.

Then it should be noted that even the brown winter spore produced by the mildew will be harmless, unless the spores formed at the tips of its branches in the spring rest on the leaf of the barberry. The farmer should not permit the barberry to have a place in his hedge, or in plantations on his farm.

Further, that while rust may in itself be injurious to the crop, it is more dangerous at the earlier stage of the mildew, and as the producer of the crop of spores which produce mildew. The only check to the rust is a bright sun and a warm dry atmosphere.

From the history of the fungus it is manifest that at no stage is it under our control; and though we can take steps which may prevent at different stages the unnecessary increase of the spores, we must be baffled in any attempt to prevent the appearance of the disease, whether in the rust or the mildew stage.

I have never observed any variety of wheat that has escaped mildew at a time and in a district where mildew was prevalent. Sometimes one field may suffer less than another in the same district, and at the harvest may yield a heavier and better field-grain, but this I have found to result from the time at which the field was attacked by the disease. Some of the prepared food of the plant may have been stored in the seed before the parasitic robber interfered with its transmission. An early field may consequently suffer less. But when the atmospheric conditions have been present for the germination of the spores, I have failed to detect any difference in liability to blight, arising either from the variety of the wheat, or from the method of cultivation.

SULPHITE WOOD PULP PROCESSES.

THE controversy on the wood pulp processes is likely to accumulate a considerable technical literature of its own. The *Papier Zeitung* has just reproduced in a free translation an article on the subject from a French paper-maker's point of view, which appeared in the *Moniteur de la Papeterie Française* of the 1st April, written under the technical authority of M. E. Bourdilliat, and entitled "Etude comparative sur les pâtes aux bisulfites." This article, which contains much that is instructive, may be interesting to our readers.

M. Bourdilliat tells us that sulphite pulp will very soon make a revolution in the manufacture of paper-making materials, and will, it is to be hoped, lead us out of a dilemma into which we have fallen through foreign competition. He says:—

The patents on sulphite experience since 1866 are sufficiently well known, and there is no difference from first to last between them; it is superfluous to discuss their value. On the other hand, it may be interesting to show the different stages of this new industry, to prove its advantages and disadvantages, in fact, to show everything which earnest study of the question has taught us; and it is important to know the different methods and improvements which have been made in this chemical operation, and which by our experience we have found to be effective.

PREPARATION OF THE SULPHITE.

The bi-sulphite compounds may be regarded in the light of sulphurous acid combinations in solution, and are collectively more or less soluble. We will examine the bi-sulphite compounds which have as yet been brought before our notice, *viz.*, those of lime, magnesia, and soda.

Sulphurous acid, which is the most important of our new leys, can be produced in several ways. By burning sulphur in contact with air; also from iron pyrites, and from the calcination of the mixture of sulphate of iron with lime and saw-dust, which has been used for purifying gas, containing about 40 per cent of sulphur.

The purest sulphurous acid is obtained by burning sulphur; that made from pyrites contains sulphuric acid and arsenic. The purest pyrites contains from 45 to 49 per cent of sulphur, of which from 40 to 44 per cent can be converted into sulphurous acid. In crude sulphur there is 95 per cent of sulphur: so 200 kilogrammes of pyrites is equal to 100 kilogrammes of crude sulphur. Sulphurous acid drives off carbonic acid from all its combinations, therefore can combine with the carbonates of lime, magnesia, or soda, as well as with the respective bases.

Bi-sulphite of lime can be produced in large quantities by introducing sulphurous acid gas (obtained by one or other of the before-mentioned methods) into the bottom of towers 20 to 30 metres high, in which limestone as it comes from the quarry is piled up; water is allowed to trickle down from the top of the tower in a number of small streams which is then conveyed into receivers. The sulphurous acid must drive off the carbonic acid from the lime before it can combine with the latter, and the towers are built high on purpose to give sufficient time for this operation to take place.

If ordinary lime, *i.e.*, burnt lime, could be used the combination would take place much more rapidly, and a height of 6 to 8 metres would then be sufficient; the water, however, falling on it would slake it and increase its volume, and the consequence would be that the tower would get blocked up, when the acid would only pass through with difficulty, or not at all. The same difficulty, only in a worse form, would take place with chalk.

As sulphurous acid is necessarily impure through containing sulphuric acid, it results that some sulphate of lime is formed, which is very difficult to dissolve, and, therefore, covers the limestone, so that it impedes the sulphurous acid acting upon it. To get rid of this sulphate of lime it is necessary to wash the limestone from time to time, and in order at any time to start working a fresh tower, several are built together with channels connecting them through which the sulphurous acid can be introduced into any one of them at pleasure.

The towers are built of brick or wood and lined out with 3 m.m. thickness of sheet lead, the joints of which must be united by burning. In addition to the heavy cost of the towers there are drawbacks to contend with, *viz.*, irregular piling up of the limestone occurs in the tower, as it has to be introduced at the top, and thereby the passage of the sulphurous acid is impeded. In order to preserve the lead lining and to avoid repairs it is advisable to wall over the inside of the towers with silicious bricks, similar to the "Glover" towers for concentrating sulphuric acid.

Bisulphite of lime could also be produced without towers by means of an apparatus conveying the sulphurous acid gas into a chamber filled with milk of lime.

Bi-sulphite of magnesia is produced in the same way as bi-sulphite of lime, only with the difference that the magnesia is first calcined, and the towers can, therefore, be used of a height of from five to six metres: as the carbonic acid has been driven off by the burning of the magnesite, the magnesia is in a proper condition to combine very quickly with the sulphurous acid, and as sulphate of magnesia is much more soluble than sulphate of lime it is much better washed by the falling water.

Bi-sulphite of soda can be produced direct by substituting a solution of soda for the water in the tower, which is packed with some neutral material such as coke or bricks. Simple as this operation is, it is not to be recommended; it is actually cheaper to produce bi-sulphite of lime and to decompose this with sulphite of soda. From this is obtained soluble bi-sulphite of soda, which is used, and insoluble sulphate of lime results, which still containing some sulphite of lime can be used as antichlor or for filling up. The advantage in this last process consists in sulphate of soda costing only six to seven francs per 100 kilos., but soda costs twenty-one to twenty-three francs.

USE OF BI-SULPHITE.

The properties of sulphurous acid can be read up in any book on chemistry. It is sufficient for us to know that its solutions have an energetic effect on extractive matter, and that it affects the colour of materials by abstracting acids from them or makes colourless combinations with them, in which case one can detect the presence of sulphur. Sulphurous acid works as a reducer or acid extractor, whilst soda on the contrary dissolves the resinous matter attacking the fibre by oxidation, so that it is evident that we cannot use sulphurous acid by itself, but only in combination with a base, and for the following reasons:—

1. For a chemical to act properly on a material like wood, the latter should be sufficiently soft and spongy for the chemical to thoroughly penetrate it. In order to effect this the wood is boiled in contact with the ley at a high temperature. Now the solutions of sulphurous acid are very unstable, not only in contact with the air, but particularly affected by a high temperature, and cannot therefore be kept in store for any length of time: the sulphurous acid in solution would be converted in large quantities into gas, and the wood would be only in water, while the gas would collect in the upper portion of the boiler; in addition to this sulphurous acid at 60 deg. C. is a vapour.

2. Sulphurous acid does not attack gums and resins so strongly or vigorously that they can be washed out afterwards.

3. We know by experience that sulphurous acid by itself, even if it sufficiently decomposes the wood, gives it a reddish colour, especially if it has combined with it in a gaseous form or with steam. In presence of a base it is possible to prepare the ley beforehand, which moderates the volatility of the sulphurous acid at a higher temperature and hinders the formation of sulphuric acid, and also the colouring of the material under treatment.

According to the present established theory, which really has to do with the deoxidation which chemists ascribe to sulphurous acid, there is produced during the boiling large quantities of sulphuric acid, which more or less interfere with the energetic action of the bisulphite bases. We do not believe in this reaction, and therefore agree with Lioud that if sulphuric acid, and also necessarily sulphates of lime, magnesia, or soda are formed, so these combinations would be found in the ley, especially if they are as soluble as the soda salts.

The analysis of M. Joseph de Montgolfier, Assistant in Chemistry at the College of France, gave the following results as regards the ley:—

1. That there is not the slightest trace of sulphuric acid combinations, therefore, that no sulphuric acid is formed.

2. That the fresh unused ley of bisulphite of soda contains 126 grammes of sulphurous acid per litre, whereas after boiling there remains still 106 grammes. The difference explains the loss, to a

certain extent, which results from boiling; and, on the other hand, that a certain quantity of the sulphurous acid remains in combination with the incrustations and resinous matter in the wood, or in the state of reduced sulphur: when the boiling is effected by direct firing (without steam), there is a greater loss. To prove this analysis, sulphite pulp, which had been prepared with bisulphite of lime, was burnt, and only contained 1·6 per cent of ash, so could not have contained any mineral matter.

The theory of the presence of sulphuric acid is, no doubt, incorrect, as in the spent ley almost all the sulphurous acid is recovered; there must, therefore, be some other explanation of the chemical effect produced.

We must here, however, mention that the ley had been used to boil 25 kilos of wood, and that it was produced from nearly pure sulphurous acid. In manufacturing sulphurous acid on a large scale from pyrites, sulphuric acid is always formed, consequently with the produced bisulphite, combinations of sulphate of lime, magnesia, and soda will also be produced. In such a case an analysis of the spent ley would show the presence of these combinations with sulphuric acid, and a test would prove whether the ley contained any before being used.

We are not credulous enough to believe that we have arrived at the true theory in the process of boiling, for very careful investigations, which are beyond us, would be required to prove this. We only give our views on the subject that sulphurous acid separates the extractive matter of wood under the influence of heat, and bleaches the colour in the material, whilst uncombined sulphur is driven off, and that finally the resin, which is hardly attacked by the sulphurous acid, forms soapy compounds, more or less soluble, with the bases of the bisulphites. It is even possible that the sulphur and the soaps may form gummy combinations which adhere to the fibre, increasing its weight.

According to these foregoing remarks, especially to the circumstance that no sulphuric acid is produced in the boiling, it would seem that it would suffice to use a boiler made of such metal as would withstand the bisulphite combinations, and by the use of such a metal dispense with the lead lining. We merely mention this improvement in passing, as every experienced man will know that not only the construction of the boiler would be facilitated, but also the cost of repairs reduced, the boiler would last longer, and a great many difficulties which now appear to be in the way would be removed. The metal that would perhaps be best suited would be a sort of copper, which M. Lioud not long ago patented. Experiments which are now in progress will put us in the position of judging whether this metal is fit for the purpose.

All manufacturers were astonished at the immense yield obtained by the sulphite process, as it was much larger than that derived from the soda process, and even much greater than most cellulose, which, according to chemical analysis, is contained in wood. This additional weight, however, is not obtained by the addition of mineral (load), which may be determined by analysis, but is owing to the sulphur and resinous combinations which burn off without leaving any residue.

Comparison between the Differently Worked Bisulphite Pulps—Boiling, &c., &c.

We will now explain the respective systems by which the sulphite pulp is produced, *viz.*, by bisulphite of lime, magnesia, and soda. The sulphite of lime pulp, as it comes out of the boiler, is hardly fit for better-class papers than news and ordinary printing; if it is required for better sorts it would be necessary to thoroughly wash it, and then bleach it, by which it would lose according to M. Knösel (No. 47 of the *Papier Zeitung*), 28 per cent. We had the opportunity of mentioning this to one of the most important Swiss paper-manufacturers, and he confirmed that the loss was considerable in washing and bleaching.

We recommend manufacturers not to work large quantities of sulphite pulp without having washed it beforehand one or two hours, as it contains sulphurous acid, which attacks the metal of the engines, as the above-mentioned manufacturer has found out by experience. The washing may be accelerated, and the sulphurous acid driven off, by adding muriatic acid. The loss which takes place in the washing is not fibre, but the combinations of sulphur, resin, and lime, which are set free through the action of the roll, and it is this which is lost, being washed away by the drum-washer.

The boiling process seems to be simple enough, and one has only constantly to renew the inner lining of lead, which suffers more from the expansion and contraction of the boiler plate than from the action of the bisulphite or gases which are generated during the process of working. Great importance seems to be attached to the size of the boilers, as they are built 4 metres in diameter and 20 metres long. We cannot understand, however, how the size of the boiler affects the boiling when the trials made in an experimental boiler containing 25 kilogrammes of wood did not vary in result from those done in a manufacturing boiler holding 1,500 kilogrammes.

We will not dispute about the cost of production of sulphite of lime pulp as we have not got the figures concerning keeping the boiler in repair and duration of same, which really constitute a considerable portion of the cost. Moreover, no one in France has yet been able to estimate the cost of production.

Sulphite pulp made by the magnesia process appears to be better suited for ordinary and finer paper as it is cleaner, and contains less heavy matter; it washes well, and the best rags do not bleach better. We do not know whether this result is owing to more careful treatment of the wood, or whether it is owing to the use of magnesia instead of lime, but will merely state the facts which may explain the results.

The boiler is jacketted, and is heated by blind steam, so that the ley inside does not become weaker (more dilute.) Moreover, as the ley is used in a more concentrated form than in the lime process, and the combination of sulphurous acid with magnesia is less stable than with lime, so the chemical effects must be greater in the same time and with the same temperature. We may assume that indirect heating from without is indispensable.

During the process of boiling, the pressure in the boiler and in the steam jacket varies a good deal. In the boiler the temperature is more elevated, which goes to prove that sulphurous acid in the gaseous form is given off, which, as before explained, takes a higher tension than steam at the same temperature. During the boiling, care must be taken to let off constantly the superfluous gas, so that the pressure in the boiler and the steam jacket does not vary more than two atmospheres. If these precautions are not taken, an over-pressure might readily cause an explosion. The method of boiling with bisulphite of magnesia with indirect heat is well founded. It will be noticed that sulphite pulp produced by this system contains charred portions, which goes to prove that some of the wood which has not been covered by the ley has been in contact with gaseous sulphurous acid. To counteract this, it is not sufficient to cover the wood in the boiler with a perforated plate of lead in order to keep it under liquor, as in consequence of the constant evaporation of the liquor the time must come towards the end of the boiling when the wood is not entirely covered, and as the boiler is stationary so necessarily this part of the wood which will be uncovered is acted upon by the gas, and becomes charred. One will now comprehend that the boiling with bisulpite of magnesia must be very carefully watched to regulate the pressure and keep it even. It is necessary to have two men constantly in attendance, as it would be dangerous to trust to one man on account of the abundant amount of gas given off, and the consequent smell. It is not difficult to detect imperfections in the lead lining in the boilers during both processes.

Magnesia pulp is more expensive to produce than lime pulp; less on account of calcined magnesia being more expensive than lime as on account of the loss through washing and bleaching—this may be the case, but we are not fully informed thereon. It may be assumed that sulphurous acid is given off in both processes in the same way.

The additional price of 7 to 8 francs per 100 kilos of the magnesia over the lime pulp, may to a great extent be due to its being of a better quality.

Soda Sulphite Pulp.—We have already explained above how bisulphite of soda is produced, but have no practical experience in the matter which would be of any value, *re* the equivalent value of the pulp. The first manufactory which will be worked on this system is now being built, and we shall be able to learn the result; we have concluded that the ley has a similar effect to that of the magnesia, and that it is in any case better than that of the lime.

* * * * * * *

At first direct steam is employed for the boiling, and afterwards boiling is effected through a serpentine pipe (Patent Kudelski). For boiling a revolving boiler is used; by this the charring of the fibre is avoided, and the process accelerated. The whole arrangements of this process appear to deserve the attention of manufacturers, but we will reserve our opinion upon it until it proves itself to be practical.

We will conclude by putting together a few facts which appear to us correct:—

1.—Lime sulphite pulp will be used for new and common printing papers, or to all sorts of paper which will not necessitate the washing and bleaching of the pulp.

2.—Magnesia and sulphite of soda pulps will, on account of their cost of production, be used only for better and finer sorts of paper.

3.—It appears clear that copper, bronze, or some other metal, which will resist the action of the sulphurous acid, must take the place of the steel-plated boilers lined with lead.

4.—That the towers, which, on account of being 90 feet high, cost at least 90,000 francs, will be superseded by a less costly arrangement.

5.—For cleaning the boiled pulp, similar strainers to those used for removing the knots and unboiled portions of straw will be used, by which means the pulp would be cleaner and freer from sheaves.

THE "GERM THEORY" OF SILKWORM DISEASE.

IN 1865 the weight of the silk-cocoons produced in France was 8,000,000 lb. Large as this amount seems, we may be able to discover the enormous falling off which the 1865 crop exhibited, when we learn that in 1853 the weight of silk produced was 52,000,000 lb. In a single year—that of 1865—the fall produced a loss of 100 millions of francs. In 1853 the *revenue* was 130 millions of francs; and we also learn that in the twenty years prior to 1853 the revenue from silk culture had doubled itself. The vast and overwhelming nature of the catastrophe, which thus threatened the commercial prosperity of France, can be fairly judged from the foregoing figures. During a period of fifteen years the silkworms (or caterpillars of the silk-moth), had died off by thousands, smitten by a disease which appeared mysterious alike in its origin and in its spread. No such calamity can befall any nation without attempts being made to stay the progress of the disease. As in the case of the existent vine-disease, remedies were proposed by the score. One author, writing in 1860, remarks that the *materia medica* of the silkworm "is now as complex as that of man. Gases, liquids, and solids have been laid under contribution. From chlorine to sulphurous acid, from nitric

acid to rum, from sugar to sulphate of quinine—all have been invoked on behalf of this unhappy insect."

To such a pass had matters come in 1863, that the Minister of Agriculture, as representing the French Government, signed an agreement, binding himself to pay 500,000 francs to the happy discoverer of a remedy which was said to be successful in arresting the disease. The remedy was tried, but without success. It was at this juncture, in June 1865, that Pasteur appeared, prepared to undertake a thorough and scientific investigation into the mysterious plague which, so far, had ravaged the insect tribe unchecked and at will.

Prior to the appearance of the dread disorder—which, by the way, was known as *pebrine*—it was noted that an affection named *muscardine* had attacked the silkworms. One Bassi had shown that the "muscardine" was undoubtedly caused by the growth within the silkworms, of a minute parasitic plant. In due time, these disease-plants gave origin to their microscopic "spores," or seeds. The spores, conveyed by the wind, carried the disease to regions in which it had been unknown. "Pebrine," however, was a far more fatal malady than "muscardine." The former caused black spots to appear on the bodies of the worms, and from this fact the name of the affection was derived. It affects the growth and nutrition of the little spinners of the silken thread, and finally causes their death. Doubtless the prior discovery of the parasitic and plant-nature of "muscardine" assisted Pasteur somewhat in his search after the cause of the "pebrine"; and he was armed likewise with other items regarding the nature of this plague, which proved useful in guiding his footsteps towards its true seat and origin. So early as 1849, curious rounded bodies, showing apparently independent movements, were known to occur in the blood of the silkworms. These "corpuscles" multiplied in the insect's body, and, undoubtedly, as was proved by Cornalia, caused the disease of the insect. Later on, these mysterious "corpuscles" were seen to inhabit even the eggs laid by the silkmoths, and from which new silkworms spring. The egg was thus apparently infected from the parent, and in turn, the infection, of course, grew with the silkworm, and thus became a hereditary complaint, propagated from parent to offspring.

A silkworm suffering from disease of this nature, seems to be affected in every part of its frame. The "corpuscles" literally reign over its body. When the diseased insect begins to "spin" its attempts are in vain, for the silk glands, instead of providing the fluid material, as in health, are filled with the corpuscles. Complete disorganisation of the structure and life functions of the unhappy insect prevails, and it ultimately dies, vanquished by the hidden enemies that have thus multiplied in its blood.

Pasteur, at the outset of his discoveries, drew attention to one very important point. The corpuscles, he saw, were small, and comparatively undeveloped in the egg. In the young worm even they might escape notice. But with the insect's growth its "unbidden guests" also increase in number and size; while, lastly, in the chrysalis, and in the full-grown moth itself, the corpuscles are large and readily seen. Hence appeared clearly enough the reason why the old methods of testing the eggs was fallacious and untrustworthy. The egg might apparently be healthy, and yet contain the germs of the disease fully represented in its constitution. But it is different with the moth. By passing the egg, the disease was liable also to be overlooked. By beginning with the diseased parents, or moth, in which the presence of the corpuscles could be fully traced, no difficulty was experienced in pronouncing an opinion regarding the probability of the disease being reproduced.

Like all reformers Pasteur experienced great difficulty in persuading the silk-growers to accept his dicta. They ignored the fact that a fine-looking cocoon might harbour a diseased moth. The egg, as we have seen, gave no hint or prophecy of what the moth might become; and as often as not, the diseased eggs, chosen by the growers, produced bad moths. So convinced was Pasteur of the surety which lay in taking the moth as the fulcrum upon which to move the lever of thought and research, that in 1866 after inspecting fourteen parcels of eggs which had been selected for hatching, he wrote and deposited in a sealed packet his view of the probable results which would follow the development of the eggs. In 1867, the growers told their story. Pasteur's letter was then opened, and his prediction was so far verified that in twelve out of fourteen cases the results agreed exactly with his views. He had said in his letter that many of the worms would perish completely, whilst others had well-nigh been extinguished by the disease, and the result was as he had predicted. Had the moths of 1866, from which the eggs had been taken, been inspected, as Pasteur advised, none of the fourteen packets of eggs would have been allowed to undergo development. Two packets of eggs he pronounced in 1866 to be sound, and born of healthy moths. These packets bore healthy caterpillars and thus in a reverse way verified the correctness of his views.

The result of Pasteur's labours in connection with *pebrine* may be predicted from the foregoing account. By rearing healthy eggs, and by the destruction of all unhealthy and diseased moths and worms, Pasteur restored to France the well-nigh ruined industry of the silk-growers. He elaborated his methods to such an extent and perfection, that he was enabled almost to predict the exact extent to which the disease would prevail in a given case. He showed that infection was conveyed by the wounds which the worms inflicted on one another with their claws. He proved the infectious nature of the disease by infecting a mulberry leaf with the diseased matter, and by showing that the healthy worms which had fed but once thereon, in due time became diseased. He demonstrated that only by destruction and isolation of affected worms could the disease be stamped out, and a new and healthy breed secured. In a words Pasteur showed that pebrine was due to a plant-growth and propagation within the animal tissue.—*Health.*

CINCHONA.

CINCHONA CALISAYA.

At the meeting of the Linnæan Society, on Thursday, the 3rd ultimo, a valuable and interesting paper was read by Mr. J. Elliot Howard, F.L.S., the well known quinologist upon Cinchona "Calisaya, var. *Ledgeriana*, How., and *C. Ledgeriana*, Moens," and in illustration of his remarks there was a magnificent display of Cinchona plants, bark, seeds, dried specimens, &c., brought together by Mr. J. Elliot Howard himself and by Mr. Thomas Christy, F.L.S., and the keenest interest was taken in these by the members of the society present.

Mr. Howard commenced his paper by recalling the fact that in 1866 he had, in a paper before the Botanical Congress, quoted Mr. Markham's statement that although the Cinchona Calisaya not only was the most famous of all the S. American bark trees, and in its native forests the most beautiful in appearance and the richest in quinine, it had not proved a success in India. Mr. Markham deplored the stunted, shrubby appearance of the trees growing in India three or for years old, with a height of less than 6 feet, and 6 inches girth; "as different as possible," he said, "from the glorious Calisaya of the Caravaya."

At the time Mr. Howard ventured to express a hope that, nevertheless, the time would come when Calisaya must, in India, assume its rightful position as the queen of all quinine-growing species, and this hope, he said, had been now realized by the introduction of mixed seeds of the very best kinds of Calisaya by Mr. Ledger, a service very ill requited by the Dutch Government.

In the *Journal of Botany*, of November, 1881, Dr. Trimen published an account of a cinchona which he called *Calisaya Ledgeriana*, Moens, being a tree that had been found growing on estates in Ceylon, five or six years old, the character of which was not known until Mr. Moens's visit to the island in 1880, when he pointed them out as *Ledgerianas*, and Dr. Trimen thereupon gave them the name of C. *Ledgeriana*, Moens, but, as Mr. Howard showed, they realised the description given by Markham of the Indian Calisaya as stunted and shrubby, and prematurely decayed.

There was nothing, however, to show that these trees had been raised from seeds brought by Mr. Ledger, and in fact their identification rested upon the botanical accuracy of Mr. Moens's description.

Mr. Howard seemed inclined to believe that the plant figured and described by Dr. Trimen is the male form of Cinchona *Micrantha*, var. *Calisayoides*, the female plant of which is figured in Curtis's "Botanical Magazine" as *C. Calisaya*, var. *Josephiana*, by Sir J. D. Hooker. It also bears some resemblance to the plant described by Howard as *C. Forbesiana*.

Mr. Howard was emphatic in his opinion that this *Micrantha* variety ought to be avoided in cultivation, and he mentioned that he was more free to indicate the mistake committed by others, because he himself had been deceived into growing and distributing as "true Ledgeriana" seeds forwarded to him as such by Mr. Moens as *Ledgeriana*, but which turned out to be nothing of the sort, as was fully proved when he cut down one of the trees and analysed the bark, comparing it also with bark sent to him from Jamaica grown from the same seed. He had been misled by the name *Ledgeriana* attached to the E.I. seed which he raised; and was now sensible that the "Micrantha like aspect" of the trees noticed by his Indian friends more correctly indicated their true character.

It was evident, Mr. Howard continued, that none of the low varieties of Calisaya would repay cultivation, and that no reliance can be placed on any description unaccompanied by careful observation.

He called attention to some plants on the table, grown from seeds from the Yarrow estate, Ceylon, as taken from trees that yielded 7 to 12 per cent. of quinine, and he pointed out the rich velvety appearance of the leaves that is so highly characteristic of the glorious Calisaya of the American forests.

With the exception of Mr. Ledger, no one had received from South America true Calisaya seeds except Mr. T. Christy, who had contributed a valuable collection of specimens grown from this seed. Mr. Howard explained how he had planted seeds given to him by Mr. Christy, at the same time with those received from Ceylon, and they grew up side by side, evidently coming from the same stock; but Mr. Christy's seed was rather the more vigorous

and showed distinctly the two varities of *Calisaya Verde* and *C. Morada*.

When Mr. Ledger's seeds were in this country, he (Mr. Howard) was consulted by Mr. Money regarding them, and gave a favourable judgment from the appearance of the capsules, as being of the *Microcarpa* variety of Calisaya.

Dr. Weddell's *Microcarpa* differs, however, from *Ledgeriana* in the character of the under surface on the leaves, but Dr. Weddell gave him specimens of Calisaya barks obtained in his second journey, which closely resembled the Verde and Morada of Mr Christy.

Nothing can be more important for the classification of Cinchona than a close examination of the barks (said Mr. Howard), and he handed round branches of both *C. Calisaya* var. of *Ledgeriana* How., and of the *C. Ledgeriana*, Moens, to show the difference between them, which was, in fact, very marked.

He then went on to quote from Mr. Van Gorkom's recent book to the effect that in Java the *Ledgeriana* were easily recognised by the peculiar uniformity of their bark and the small white flowers, and he said that in that island great care was taken to preserve the best trees, whereas in India he was afraid many of the best trees of *Succirubra Officinalis* had already been cut down.

Mr. Howard then went into the question of hybridisation, and remarked that there had been more imagination than fact introduced into this controversy. He lamented the great loss to science in the early death of Mr. McIvor, who had gone into the matter critically. He had received from him carefully selected specimens of hybrids, but they did not suffice in his opinion to establish any theory. He would not deny hybridisation, but he thought it was very local, and quoted letters from Mr. Ledger to the effect that whilst trees on the outer fringe of the plantations deteriorated, those in the inside continued to give the best quality of bark, and though differences still appeared in their foliage at the time of flowering, they were visited by thousands of humming-birds and bees.

He stated that the wrong species had been cultivated in India and Ceylon, the *Succirubra* having there taken the place of the superior *Calisaya*, the *Succirubra* being inferior for both pharmaceutical and manufacturing purposes.

Mr. Howard exhibited a bark which had been sent to him by Mr. McIvor that had been taken from a tree raised from seed sent out to India, and in which owing to cultivation, the produce of quinine had increased in about fourfold ratio. In Mr. Howard's opinion it is not unlikely the same result may occur with Ledgeriana.

Mr. T. Christy said "that specimens of Cinchona had been sent to him from Bolivia by a botanist who had been in his employ here for some time, and for whom he had obtained an appointment with a gentleman leaving for La Paz, the owner of large plantations. Mr. Christy impressed upon him, before he went out, the extreme importance of gathering the flowers, leaves, and the seed pods of all the varieties of Cinchonas cultivated on the plantations, and that gave the best results, and he had very fairly followed out these wishes. Mr. Christy then drew attention to the dried specimens of the various varieties which were placed before the meeting, and acknowledged the great assistance he has received from Mr. Howard in classifying these plants, and he said the result was, that after a great many letters passing, and a great amount of information being thus diffused, that planters in Bolivia had found that it was to their advantage to grow the *Calisaya verde*, a very large tree, and which they found answered their purpose the best of any. It did not yield quite as much quinine as the *C. Morada*, but the growth was much more rapid and the yield of the bark was very much greater. Taking into account the twenty days' mule journey which this extra quantity bark had to support, it still paid better to cultivate than the richer variety of *Calisaya morada*, on account of the larger yield. To show the value of such a Society as the Linnæan, and of being able to compare living specimens," Mr. Christy continued, "since coming into the room, one of the plants here had been recognised by Mr. Howard and Mr. E. M. Holmes as identical with the specimens of bark sent home and named *Rubravenada*." Mr. Howard had informed him that the plant was raised from the seed he (Mr. Christy) had sent him. He had been able to identify this plant of *Calisaya Rubravenada* with the dried specimens by the appearance of its foliage and marking.

Another fact wanted ventilating, and that was that they had tried in every way to explain to friends in Bolivia, who are on the plantations, that what was particularly wanted was the *Calisaya* known here under the name of *Ledgeriana*. It was explained thoroughly that what was wanted was the variety with the red stems and red leaves called Roja by the natives. They replied, seed specially marked had been sent home several times, and different journeys were made to the mountains for specimens, but that they really could not find trees with this peculiar red marking.

Mr. Howard, when reading his paper, remarked that he noticed that the leaves turned red at a certain time of year.

Mr. Christy remarked it was curious that only that morning he had taken from a Calisaya plant in his hot-house a bright red leaf, which he thought was dead or diseased. If he had brought it, it would have been seen at once that it was of a brighter crimson than on any other plant produced. There was no doubt that the leaves did change colour at certain times of the year.

They seemed to notice out in Bolivia that the *Calisaya Morada* seed was thinner and more pointed than the *C. Verde*.

On looking at the dried specimens Mr. Howard remarked to Mr. Christy that a change was fast taking place in the distinctive marks and shape of the leaf; some leaves were geting quite pointed, like *C. Morada*, and in the Bolivia dried specimens, they called them lanceolate shaped, &c., &c.

Mr. Christy said he had brought with him the *Calisaya Ledgeriana* obtained from seed sent from Java, and it agreed pretty nearly with the plants brought there that evening, *viz.*, those of the *Calisaya verde*. Mr. Howard's conclusions were, it seemed to him, that the true *Ledgeriana* giving 7 to 12 per cent of quinine agreed exactly with the plants raised from Bolivian seed. Again, the cinchona planters agree with Mr. Howard in stating that the only varieties worth growing is the *Calisaya*, and they select the *Calisaya verde* as giving them the best return for their capital expended.

Mr. E. M. Holmes asked if Mr. Howard had seen Dr. Trimen's recent paper in the *Journal of Botany* for May 1882, in which Dr. Trimen stated that there are no *Ledgerianas* in the East which have not descended from Ledger seed. If he understood Mr. Howard rightly there were several forms passing under the name of *C. Ledgeriana* which were not the true plant, but that some of the plants raised from Mr. Christy's seed were identical with the true *Ledgeriana*, and that these were distinguished by the velvety gloss and the ciliated margin of the leaves. He could now understand how it was that the Bolivian planters did not recognise the *roja* variety because it was obvious that the colour was only temporary. Mr. Christy's seed, judging from the plants exhibited, evidently includes not only the true *Ledgeriana* but also the *Morada* and several forms of the *Verde*, such as the *Rubravenada* and *Albovenada*.

Mr. Howard replied that he had not seen the article alluded to.

Mr. Howard made a few remarks in reply, but as we were unable to decipher, satisfactorily, the notes of those made by us at the meeting, we ventured to ask Mr. Howard to transcribe them himself, and he has very kindly favored us with the following :—

My reveiw of the whole subject is briefly as follows :—Dr. Trimen and Mr. Moens, wishing to describe (as a new species) the very same *Ledgeriana* trees, of which I had given description and analyses of the bark, with plates drawn and colored by our most able artist, and which I had thus published as a variety of Cinchona Calisaya, took for typical specimen of the same a tree found in Ceylon, derived apparently from seed given by Mr. McIvor, of uncertain origin. I think it will be evident to any botanist comparing the plates and description, that they differ very widely, and on Mr. Moens' own authority I claim that mine alone are authentic. I believe the tree figured as C. *Ledgeriana*, Moens, to be no Calisaya at all, but either a true species standing intermediate between Calisaya and Micrantha, or a mere variety of Micrantha. Comparison of plants manifest this still more closely, and also shows the very close resemblance between the *Ledgeriana* and the *Morada* and *Verde* varieties of Calisaya, all perhaps standing under the var. *Microcarpa* of Weddell. The real *Ledgeriana* is not the *Verde*, nor the *Morada*, but that which is known in its native habitat as the *roja* or red, from the leaves turning a bright red (under circumstances), as noticed by Mr. Ledger in Bolivia, and by Mr. Christy and myself in our authentic plants. The leaves of these seem to me more sensitive both to the influence of light and temperature than the others named. The *roja* seems to be a more delicate tree than the *Verde*, and is (perhaps consequently) not found in patches, but isolated; neither has it as yet been cultivated. I have noticed various points of difference from the *Pseudo-Ledgeriana* of Trimen which would no doubt in part disappear,

through the rough influence of climate and weather; but the glorious Calisaya of the Bolivian forest cannot permanently be confounded with the *micranthoid* variety with which it has been supposed identical. The bark alone, as noticed by Mr. Von Gorkom, is a sufficient distinction.—*Ceylon Observer*.

CINCHONA CULTIVATION: ITS FINANCIAL ASPECTS.

A PLANTER, S. E. Wynaad, writes:—There has, within the last three years, been quite a rage for cinchona planting. Every-one has taken to planting cinchonas, to a great or less extent; and we all have, or have had hopes of making fortunes out of the bark, and being able, notwithstanding the fickleness of our old love of coffee, to retire, some of us, after many years of exile, to England, and those home comforts which memory paints for us in the brightest hues.

The cinchona mania has some *raison d'être*. Money has undoubtedly been made, and is now being made, from cinchona; and estimates, drawn up by authorities on the subject, show us what handsome profits are still likely in their opinion to be derived from the cultivation. But, looking at the rapid extension which has been made in cinchona cultivation of late, the question naturally arises, will the demand for, and consumption of, the bark keep up with the supply, so as to insure paying prices some years hence, when trees now being planted will have reached the producing stage? Philanthropists may rejoice when "the bitter blessing" is brought within reach of the poorest in the land; it will be well for the world generally; but will it be altogether satisfactory for the individual planter? Though he has his fair share of the milk (unadulterated) of human kindness; it was not philanthropy alone which induced the planter to spend his best years in fostering the fever-slayer; *cela va sans dire*. Neither was it revenge on the malignant goddess, Malaria, for a shattered constitution.

I calculate that there are now growing in Pykara, Neddiwattum, Ouchterlony Valley, and S. E. Wynaad, 5,000,000 cinchona plants; 10,000,000 may be put down for North and South Wynaad, Ootacamund, Coonoor, Kotagerl, Kartary, Koondahs, &c., giving a total of 15,000,000 plants for the Wynaad and Nilgiris. We have besides Mysore, Coorg, Travancore, and other districts in Southern India, and Sikhim and Darjeeling in the North, where cinchonas have been extensively planted; and I do not think I would be far wrong in putting down another 15,000,000 as the number of plants now growing in these parts; giving, with the cultivation in Wynaad and Nilgiris, a total of 30,000,000 plants for the whole of British India. During the next two planting seasons, 1883 and 1884, I believe a larger number of cinchonas will be planted out than in any previous years; and by the year 1890, there will be in British India not less than 40,000,000 cinchona trees (yellow, crown, and red barks) none of them less than 5 years old, with an annual producing power, allowing ¼lb per tree, of 10,000,000lb of bark, that is to say, more than half the amount of the present average annual outturn of bark in South America, from all sources. Then, there are Ceylon, Java, Jamaica, Mexico, and other countries which have gone, and are still going, in largely for this cultivation; and though it has been reported that the South American cinchona forests, owing to the wholesale harvesting, are rapidly decreasing, it is difficult to get reliable information on the subject, and it seems unlikely that South America will cease to be a large producer of bark for several years to come. I do not think it would be too much to put down the production of bark, in 1890, in countries other than British India, at 40,000,000lb, which would bring the whole world's production to the grand total of 50,000,000lb annually; or, as far as I have means of learning, more than double the present annual consumption, and, even allowing for a large yearly increase in the demand for bark, far more than is likely to be required to supply the world's wants at that date.

At the present time, inferior bark (twig and branch) is not worth shipping; being "a drug" in the market the druggists will have none of it; and if the German brewers want to make use of it instead of hops for their beer, one would naturally suppose that they would be willing to give for it what would at least pay the grower for the freight and charges, especially this year when the supply of hops was reported to be short. It remains to be seen whether the price of a great deal of our stem bark will not, within the next few years, fall to a point at which it will barely pay us to grow it. There is scope for the extension of the consumption of quinine of course, but it is not unlimited scope. Those countries favoured with cheap labour, and suitable soil and climate, may be able to derive fair profits from cinchonas for some years to come; and amongst cinchona growers, he who is most careful in the selection of his seed, and gets a strong-growing variety with rich bark to flourish on his land, will be better off than others. But to those who may contemplate going in for cinchona cultivation, I would point out that the grand results talked of as having been obtained and being now obtained by some in this branch of agriculture may, as far as they are concerned, be relegated to the limbo of past possibilities.

THE GARDEN.

CINERARIAS BY CUTTINGS OR OFFSETS.

THE cineraria, as is well known, is so apt to vary when raised from seed, that no two plants in a thousand can be relied upon to turn out to be exactly alike. Yet one often meets with a sort among a batch of seedlings that it would be desirable to perpetuate. But as this cannot be done by means of seed sowing, the grower must adopt the only known method of propagating the characteristics of any particular sort of this or any other kind of plant which has the same peculiarity of varying from seed; that is, by means of cuttings or offsets. The difference between a cutting and an offset is that the former is a shoot or piece of growth without roots, while the latter is a shoot with roots more or less, and always to be found proceeding directly from the underground rootstock of plants of the same character of growth as the cineraria. True, cuttings are not often to be had from our present subject; but if rightly treated, the plants will throw large numbers of offsets. When it is intended to increase the number of any desirable variety in this way, let the stems be cut over close to the ground when they have finished flowering. Water sparingly till they start into growth, and keep them in partial shade, in such a position as that they will not be exposed to the bright rays of the midday sun, but may have the sun morning and evening. The best place for them is a spot behind a wall facing north, not overhung by trees, but protected from the meridian heat and light only by the wall. They should not be placed here till all danger of frost is past, or if they are, means must be taken to protect them at night. They succeed best when planted out; indeed, they should not be kept in their pots, because they will not freely form the offshoots that are wanted except they have ample room to ramble and push their roots in. Never allow them to become dry, but see also that the drainage is such that they cannot possibly become stagnated with moisture. The compost must be light, rich, and open; the best that can be made is composed of light fibrous loam, old, well-rotted stable manure, and leaf mould, along with plenty of sand to add to the porousness of the mass. The offshoots may be taken off when they have attained such size as that they may be handled freely. They should be removed with a sharp knife, after clearing the soil away from them with a blunt-pointed stick. Pot them in the same character of compost as that already described for planting the parent plants in. Let the pots be small thumbs, and place them when potted in a close frame, which must be kept close and shaded for a week, after which they may be gradually inured to air and light, but the latter they should have only in the morning and afternoon till well on to autumn, when they will do without shade. After the plants are well rooted they may be potted into pots a size larger than those they were put in to strike root, and in every way afterwards they require the same treatment as seedling plants.

POLYANTHUSES.

These are very deservedly increasing in popularity. They are found to be among the most beautiful and free flowering of spring flowers. We are speaking of the fine strains of sorts that may now be obtained from seeds—not the high-class but more difficult to manage kinds, as florists' flowers. These latter are not of much use for mere decorative purposes, but the former are becoming indispensable to flower gardeners, and to all who wish to have a long period of beautiful floral display in their gardens. When they have finished flowering, all the flower stems should be cut away, except those which may be wished to bear seed. Only the very best sorts should be kept for the purpose of seed saving; those with the most clearly defined colours, the largest and best formed flowers, and which also possess good substance, only are considered the best. Another point to be regarded as strongly desirable is the strength of the flower stems; if they are weak the flowers never show up to advantage, therefore it is desirable that the seed-bearing parent should have stout stems, capable of

bearing heavy heads of flowers erect. After they are done flowering, the plants should be moved to a somewhat shady position, where they will be exposed only to the morning and afternoon or evening sun. Strong sunlight scorches the plants and weakens them, and they die from sheer exhaustion when fully exposed to the sun's meridian rays. They may be divided before being planted in their new quarters, and should be well watered till they establish themselves.

MINERALOGY.

IRON ORES.

On the Iron Ores, *and* Subsidiary Materials *for the* Manufacture of Iron, *in the North-Eastern part of the* Jubbulpore District ; *by* F. R. MALLET, F.G.S., *Geological Survey of India.*

FROM time immemorial the Jubbulpore district has held an important place amongst those centres where the smelting of iron has been carried on in the native method. Plentiful ores, extensive jungles for the supply of charcoal, and proximity to thickly populated alluvial tracts of country, combined to give Jubbulpore a commanding position in the old days before railways had brought the native hearths into an unequal struggle with the blast furnaces of England. Even now iron is made on what, from the native point of view, must be considered a large scale, numerous furnaces being scattered over the iron-bearing portions of the district.

The advantageous central position of Jubbulpore, now that it is in railway communication with the richest parts of the surrounding provinces, is too great to have escaped notice with reference to the manufacture of iron on European principles. As far as was known, ores and flux were to be had in abundance, and the means for distributing the manufactured iron to the surrounding markets was at hand. But the often-experienced difficulty of keeping large furnaces in blast with charcoal, and the absence of any available coal, were a deterrent to any decisive action.

Within the last year or two, however, the discovery of workable coal by Mr. T. W. H. Hughes, in the immediate neighbourhood of the Jubbulpore district, has given the question a new aspect. A line of railway from the new coal-field at Umeria to Murwara (Katni), on the East Indian line, has been proposed, and the preliminary surveys already executed.

The question of fuel, then, being in a fair way towards a satisfactory solution, it became important to ascertain whether the generally received opinion as to the abundance and excellence of the Jubbulpore ores was fully borne out by fact. I was consequently directed, in the early part of this year, to visit the more important places where iron was known to occur, with a view to forming an opinion as to the extent of the deposits, and the feasibility of working them, and to collect samples for subsequent analysis. The question of flux and other subsidiary materials was also to be looked into. The following paper, then, embodies the results of my work in the field and laboratory.

The iron ores, for purposes of description, may be regarded with reference either to their mineralogical characteristics, their geological distribution, or their topographical position. The accompanying map, the geological work on which is mainly, and indeed, with reference to the area with which we are more immediately concerned, exclusively, due to surveys executed by Mr. C. A. Hacket in 1869-72, shows the distribution of the different series of rocks. It will be seen that between the great spread of Vindhyan sandstones on the north and Deccan trap on the south, both of which formations are almost barren of any metallic wealth, there is a belt, some 30 miles wide, where a very varied and intricately disposed assemblage of rocks occurs. It is just here that the band of iron-bearing transition strata, which stretches eastwards for more than 200 miles through the Son Valley, comes in contrast with the thickly populated alluvial belt through which the Nerbudda flows westwards for about the same distance. Hence one of the most important advantages which the iron-smelters of Jubbulpore have enjoyed. Hematite ores similar to those of Jubbulpore are known to occur largely in the wild country to the east; but there are not the same facilities there for disposing of the manufactured product.

The formations just mentioned include—

- Alluvium.
- Rock laterite.
- Deccan trap.
- Lameta group.
- Upper Gondwana.
- Coal measures.
- Talchir group.
- Upper Vindhyans.
- Lower Vindhyans.
- Bijawur or transition series.
- Gneiss.

The Bijawur series and the rock laterite are those with which we are more immediately concerned now, for it is in them that nearly all the iron ore is contained. (1) By reference to the map, then, one sees at a glance the general lie of the iron-bearing tracts, which are those coloured respectively purple and burnt sienna, although it is only in certain portions of those areas that the ores are found. The Bijawur ores occur more especially in the Pergunnas Khumbhi and Gosalpore, while the Pergunna Bijeragogurh contains the greater portion of the lateritic ores.

(1) Some ore also occurs in the Gondwana beds, but it is "very impure and requires much selection and cleaning," and is "very rarely worth working" (J. G. Medlicott, Memoirs, Geological Survey of India. V. II, p. 278.)

Mineralogically considered, the iron ores are almost exclusively varieties of hematite and limonite (or red and brown hematite), the former being especially characteristic of the Bijawurs, and the latter of the newer formation. They may be classified thus—

BIJAWUR ORES { *1, Hematite* { Schistose hematite. Micaceous iron. Jasper-hematite. (2) Semi-ochreous hematite. Manganiferous hematite.
2, Limonite.

LATERITE ORES { *1, Limonite* { Pisolitic limonite, breaking with smooth conchoidal fracture. Pisolitic limonite, breaking with rough uneven fracture. Ordinary laterite, some parts of which contains a high percentage of iron.
2, Hematite.

Magnetite has been found in small crystals disseminated through the hematite beds of Sehora, but I am not aware of its occurring anywhere in such quantity as to entitle it to be included in the above list as an ore.

BIJAWUR ORES.

The Bijawur series has been subdivided by Mr. Hacket thus (in descending order):—

Chandardip group.
Lora ,,
Bhitri ,,
Majhauli ,,

It is in the inferior strata of the Lora group (so called from the Lora range east of Sehora) that all the most important existing mines are sunk. (3) "All the iron-workings," says Mr. Hacket, "are situated near the base of the (Lora) group, where the quartz bands (4) are absent, and the rocks consist almost entirely of micaceous iron, or mixed with a few bands of clay. The Jauli mines are so situated, as also those of Mangela, and at Agaria in the Majgaon hills, and also in the hills west of the 'marble rocks.' This band of rich iron appears to be very constant in the section, but, being softer than the rocks above, is mostly worn away, and covered by the alluvium or debris from the ridges of the harder rocks; but that the band exists is shown by the pieces of rich iron strewn along the line." (5)

A few workings in the Majhauli hills (near the western edge of the map) are situated in rocks of the Bhitri group, but these are of very secondary importance. (6)

Probably the most extensively worked cluster of mines in the district are those situated in the group of low irregular hills south of Sarroli and Majgaon (8 miles south-east of Sehora), and as the iron-bearing strata are exposed there more clearly, and on a larger scale, than in any other localities that I have visited, it will be convenient to take that neighbourhood as a starting point in any detailed descriptions.

The hill half-a-mile south of Agaria (4 miles west-south-west of Sarroli) appears to be formed entirely of iron ore. The strata have a low irregular dip towards the south. The highest beds, *i.e.*, those on the south side of the hill, where there are numerous pits, are of evenly laminated micaceous iron, interbanded with occasional argillaceous layers. The rock is so soft that it can be powdered between the fingers, and is simply dug out with ordinary *kodalis*. But the greater portion of the ore, constituting the lower beds, is schistose hematite, which is harder than the micaceous iron, although easily worked on account of its fissile character. Numerous pits have been sunk into it also. There is a thin skin of laterite on the top of the hill, which is, in great part at least, and I believe wholly, due to alteration of the iron-schist *in situ*.

As this hill is about a third of a mile long, flat-topped, and wide, and not far from 100 feet high, the quantity of ore available by open workings, with free drainage, is enormous. As a very rough estimate, the cubic contents of the hill may perhaps be taken at $\frac{600 \times 450 \times 30}{2}$ or about four million cubic yards (7) which is equivalent to about fourteen million tons of ore. Even then if a liberal deduction be made for possible concealed bands of useless rock, the remaining figures will represent an immense amount of ore.

A sample of schistose hematite from the northern side of the hill yielded on analysis—

Ferric oxide ...	... ...	97·54=Iron 68·28
Phosphoric acid	... ...	·12
Sulphuric acid	... ...	trace
Sulphur ...	... ...	traces
Loss on ignition (8)	... ...	·89
Ignited insoluble residue	...	1·21
Alumina and undetermined	...	·24
		100·00

In the low ridge which runs westward from Agaria a band of hematite schist, several yards thick, is visible along the crest.

(2) *Vide* p. 100.

(3) Here, and subsequently, in reference to native operations, I use the word 'mine' to express an excavation where ore is extracted, irrespective of its form. Underground workings are rather the exception than the rule, the majority of the excavations being irregular open pits.

(4) *Vide* p. 100.

(5 & 6) MSS. report, 1870-71.

(7) The product of the dimensions of the hill is divided by 2, to allow for the slopes and irregularities.

Elsewhere the rock is obscured by talus, &c. Except, however, near the base of the southern slope, where pieces of ferruginous sandstone are strewn, the *debris* on the ridge is entirely of hematite schist, so that considerably more ore may exist than is actually seen. The ridge is perhaps 40 to 50 feet high, and comparatively wide, with gentle slopes. Even if the hematite band is not thicker than the exposed strata, a large amount of ore is available in the ridge. The dip, as seen about half-a-mile west of the village, is to the south at 40°—50°.

In the hills south-east of Agaria, I observed runs of ore in two or three places, but nothing of much importance. At the western end of the Jhiti ridge some limonite schist is seen, dipping S. 20° E. at 40°, but no good section is exposed. This, as well as other Bijawur limonite ores, which are of rather unfrequent occurrence, may possibly be due to hydration of hematitic strata near the surface. At the southern base of the hillock just west of Kurumukur, jaspery quartz schist interbanded with micaceous iron is seen. The hillock is capped by laterite, and similar rock is to be seen in some of the hills to the north-east of the same village. These hills are low and featureless, with little or no other rock visible. It is not at all improbable, however, that the laterite is due to superficial alteration of iron ore, and that there is a considerable, perhaps a large, quantity of the latter in the hills in question.

There are two low hillocks close to Sarroli, one three-quarters of a mile somewhat south of west, and the other a mile south-south-west from the town. The former of these is composed of schistose hematite and micaceous iron, the beds of which have an irregular strike, corresponding on the whole with the direction of the hill, and an uncertain dip at high angles. There is a skin of laterite in places due, I have no doubt, to superficial alteration of the ore.

The northern part of the other hill is also composed of iron ore, which has an irregular dip, apparently towards the south as a whole. The southern part of the hill is formed of hornstone. The lower beds of ore, *i.e.*, those in the most northern part of the hill, are of hard micaceous iron passing into schistose hematite, while the upper strata are of soft, crumbly, finely laminated micaceous iron, with some interbanded argillaceous layers. It will be observed that the section here is similar to that in the hill half-a-mile south of Agaria—soft crumbly ore above and harder beds beneath—and I do not think there can be much doubt that the strata in the two localities belong to the same horizon. There are two rather large excavations in the upper beds; that to the south-east is known as the Sarroli mine, and that to the north-west as the Partabpore mine (from a village close by which is not marked on the map).

As a rough estimate of the amount of ore available by open workings, with free drainage, in the Sarroli hills, the cubic contents of the northern may perhaps be taken at $\frac{500\times150\times18}{2}$, or about 500,000 cubic yards, and that of the iron-bearing part of the southern at $\frac{300\times200\times17}{2}$, or about the same amount. This is equivalent to about 1,700,000 tons of ore in each hill, or say three-and-a-half million tons in both together. In this estimate, as in that for the hill south of Agaria, no account is taken of the ore which would be raised from open workings beneath the level of the surrounding country. From such workings an immense amount of ore could be obtained.

A sample of the crumbly micaceous iron from the Partabpore mine, taken as it was being loaded on to buffaloes for transmission to the neighbouring furnaces, yielded—

Ferric oxide	... 92·21	= Iron 64·55
Phosphoric acid ...	... ·07	
Sulphuric acid ...	... trace	
Sulphur ...	... trace	
Loss on ignition ...	... 1·86	
Ignited insoluble residue ...	... 4·50	
Lime, alumina, and undetermined	... 1·36	
	100·00	

The harder ore from the north end of the hill gave—

Ferric oxide	... 97·16	= Iron 68·02
Loss on ignition ...	... 1·30	
Ignited insoluble residue ...	... ·89	
Undetermined ...	... ·65	
	100·00	

The largest iron mine in the district is that near Juali, somewhat less than a mile south-east of the village (3 miles south-east of Sarroli). The ore is a semi-ochreous hematite, in which a slightly schistose structure is often apparent. Hematite with metallic lustre also occurs, but is quite subordinate to the more ochrey kind. The ore is interbanded with quartzose layers, which in some places greatly exceed the ferruginous part of the rock. In other places they are comparatively rare, and in the best ore they are still less common. These layers vary from a fraction of an inch to several inches in thickness. The beds are vertical, the strike, where best seen, being N. 40° E. A rough measurement showed the beds exposed to have a thickness of about 150 feet, but in estimating the thickness of ore, a deduction must be made as an allowance for the quartzose portion just alluded to.

The ore has been very largely worked, the mine being nearly 100 yards long by 50 yards broad, and perhaps 50 feet deep. I was informed by Mr. Olpherts' agent in charge of the mine, that it is not flooded in the rains; it is a sort of deep trench (the length of which coincides with the strike of the rock) in which water would accumulate if it did not soak away subterraneously, or evaporate, quicker than it entered. The surrounding country is an undulating one, and without actual levelling, it would be impossible to say to what extent free drainage could be depended on for more extensive operations.

It is from picked ore from this mine that Mr. W. G. Olpherts' 'metallic paint' is made, by grinding to an impalpable powder.

Some distance, perhaps a quarter-of-a-mile, to the north-east of the above mine, there is an old abandoned one. The ore exposed is not as rich as that in the mine now worked, and naturally so, as previous to abandonment all the best ore exposed would be removed. The beds dip E. 30° S. at 60°, the strike therefore being nearly the same as in the newer mine. Mr. Hacket considered the ore in both mines to belong to the same band, and one can scarcely doubt that such is the fact; but the ore is so soft that it makes no show at the surface, and hence cannot be traced along the outcrop. If the band is continuous, however, for even a quarter-of-a-mile only, with anything like the thickness it has in the present mine, a very large amount of ore is hidden beneath the surface.

An average sample of the Jallipore, taken as it came, and including the interbanded quartz yielded on analysis—

Ferric oxide	... 75·69	Iron 52·98
Phosphoric acid ...	... ·10	
Sulphuric acid	... traces.	
Sulphur	... traces.	
Loss on ignition ...	... 1·52	
Ignited insoluble residue ...	... 22·52	
Manganese oxide, lime, and undetermined	·30	
	...100·00	

By the aid of some picking, however, a much purer ore can be obtained. A sample assayed by Mr. A. Tween gave 96·86 per cent. of ferric oxide 68·50 of iron, and some of Mr. Olpherts' paint gave 97·10.

Before leaving the ores of this neighbourhood, I ought to mention that the hematite of Jauli and Agaria, as well as of the hills close to Sarroli, is most distinctly a bedded rock, having generally (except at Jauli, where it is less strong marked) a highly schistose character. Locally indeed the rock is crushed and re-cemented, and this crushing may have taken place along lines of faulting (probably merely local slips). But except in such very limited sense the ore is most certainly not a fault rock. The point is one of practical importance with reference to the probable persistency of the ore, and is alluded to, as the reverse has been previously stated.

The most prominent rock in the Lora range (east of Sehora) is a ferruginous siliceous schist, composed of alternating layers of micaceous iron and quartz, which is usually of a red jaspery type. The layers are of irregular thickness, varying from a small fraction of an inch to an inch and upwards. For want of a better name, and to avoid circumlocution in referring to it, this rock may perhaps be called jasper-hematite schist. If it were marked as an iron ore, the Lora range (as well as many other lines of hill) should be streaked with gold from end to end. But a large proportion of the rock contains too great an amount of silica to allow of its being smelted with advantage, more specially when ores practically free from silica are to be obtained in abundance. Only those places, therefore, are marked with gold in which I have myself seen good workable ore.

At the termination of the range north of Mangola, a band of jasper-hematite is exposed *in situ* along the crest. Lower down the slopes there is a talus of the same rock, amongst which pieces of micaceous iron 2 or 3 inches thick, or more, and free from siliceous layers, are not uncommon. But the beds are not exposed sufficiently for one to form an opinion as to whether there is any considerable quantity of ore.

The hill half-a-mile north of Gogra is formed mainly of jasper-hematite. Near the base of the southern slope there are a number of shallow ore pits, but they are only in talus, not in the rock *in situ*. The miners seek for the small bits of ore which can be used at once in the furnaces, and leave the large lumps, which would require the labour of breaking up. The ore is a manganiferous micaceous hematite, containing a varying proportion of interbanded jaspery quartz. It is a siliceous ore, although not very highly so. As the manganiferous band is entirely concealed beneath the talus, no estimate can be made of its thickness. Judging, however, from the large amount of *debris*, it seems probable that the thickness is considerable. As the loose ore must either lie, directly over that *in situ*, or else have come down hill, and as the pits extend 20 or 30 feet (vertically) from the base of the hill, probably a large amount of ore is obtainable by dry open workings whether these be through a deep mass of talus or into solid rock.

The proportion of manganese varies much, as can be seen from the outward appearance of the ore. In some specimens of the micaceous iron, the presence of manganese is scarcely apparent to the eye; in others, the ore shows by its dark colour that it contains a large amount, and in the highly manganiferous portions psilomelane occurs in irregular segregations. A carefully

(8) This and the other tion, therefore, includes of the hydrous ores,

(9) Memoirs, Geol. Surv. of India, Vol. II, p. 278.

(10) Those to the west being to the village Gogra, and those to the east Danwar.

(11) ·009.

chosen average sample made up of a large number of small pieces taken from different pits, yielded—

Ferric oxide	...	66·33 = Iron 46·43
Manganese (with trace of cobalt)	...	12·26
Oxygen	...	6·33
Phosphoric acid	...	·27
Sulphuric acid	...	·08
Sulphur	...	trace
Ignited insoluble residue	...	9·55
Lime, alumina, water, and undetermined		4·76
		100·00

The manganese exists, in large part at least, in the form of psilomelane, occurring in irregular segregation, or minutely disseminated through the rock.

The Gogra miners told me (and Mr. Hacket mentions the same thing) that the ore from these pits produces a hard steely iron, used for making edged-tools, &c., while that from the mines in the Sarroli neighbourhood yields a soft iron, used largely for *karrais* (shallow basins for making *chuppatis*, in &c.) The difference is no doubt to be attributed to the manganese in the former.

The ridge running eastward from Kuthola (1 mile south-east of Sehora) is formed mainly of jasper-hematite. At the gap where the railway passes, the strata dip at a high angle towards the south. In the low hill just west of the railway station (Sehora road), the beds in which seem to be higher in the section, as the rocks actually lie, than those just mentioned, manganiferous hematite schist, with psilomelane, is visible. The rock is more earthy and impure-looking than that at Gosulpore, which will be described presently, and contains a considerable amount of interbanded jasper and quartz. No great thickness is exposed, but the outcrop is of some importance, as indicating the position of the manganiferous band.

Where the Deccan road passes the end of the ridge, jasper-hematite with hornstone is visible *in situ*, and pieces of psilomelane, &c., are scattered about.

On the northern slope of the hillock, about 300 yards N. 15° W. from the Dák Bungalow at Gosulpore, a strong band of manganiferous micaceous iron outcrops. In a little *nulla* at the foot of the hill the following section is exposed :—

			Feet.
Clay-slate, seen about	...	...	50
Somewhat ferruginous quartz schist	...	...	5
Obscured	...	...	20
Manganiferous micaceous iron	...	...	15 ?
,, quartz schist...	...	...	5
,, micaceous iron, seen	...	...	35

The total thickness of ore actually seen being about 50 feet. The section is given in descending order, as the rocks lie, the dip being about 60° to N. 30° W.

The hillock just mentioned forms the eastern extremity of a low scarp, running from Gosulpore to W. 30° S. The scarp is capped by several yards of rock laterite, but lower down the slope (which faces to N. 30° W.) the mangano-ferruginous band outcrops in several places. It is fairly seen at intervals for about a third of a mile, and reveals its presence more obscurely, by occasional small outcrops, and by loose fragments, for at least a quarter of a mile more. As in the first third of a mile, the outcrop is well above the plain (averaging perhaps 30 feet or so), there is, unless the band thins out considerably immediately westward of Gosulpore, which is not likely, some hundreds of thousands of tons to be had by dry open workings, and probably some millions by going deep enough.

The appearance of the rock shows (as at Gogra) that the proportion of manganese is very variable. The greater portion of it, at least, exists in the form of psilomelane, occurring partly as linings to small cavities in the rock, and in irregular segregations and masses, some of which contain some cubic feet of mineral. I am somewhat inclined to think that the psilomelane is most abundant where the schist has crushed and re-cemented, psilomelane being the cementing material. A sample of the more manganiferous part of the schist afforded 18·02 per cent of manganese (with cobalt), while the psilomelane gave 83·20 per cent of available peroxide.

Reviewing the above details, it will be seen that manganiferous micaceous hematite has been found in several places along the southern side of the Lora range. One can scarcely feel much doubt as to there being a continuous band in that position. It is highly probable that the Gosulpore ore belongs to the same horizon, but whether it is a direct continuation of the same outcrop or not is more doubtful. The strata in the Lora range have a general dip towards the south-south-east at high angles, while the beds at Gosulpore dip N. 30° W. at about 60°. This may be a mere local feature, or it may indicate that the Lora and Gosulpore outcrops are on opposite sides of a synclinal flexure.

There does not appear to be any reason why the Gosulpore and Lora manganiferous ore should not form a suitable material for the manufacture of spiegeleisen. Although part of the manganese occurs in distinct segregations, a large proportion of it is minutely disseminated through the ore.

On the slope of the hillock at Gosulpore above mentioned, a little below the outcrop of the manganiferous ore, there is a band of limonite not less than 15 feet thick. It can be traced westwards for about the same distance as the other ore, to which it runs parallel. Some parts are very massive, the rock lying about in large blocks ; others present a schistose appearance. At the time I took this to be a bedded Bijawur rock, but I am not prepared to assert positively that it is so. Whether it be or not, a considerable quantity of ore (containing, however, a rather high percentage of phosphorus) is to be obtained from it. It yielded on analysis—

Ferric oxide ...	... ...	81·57 = Iron 57·10
Phosphoric acid	... ...	1·69
Sulphuric acid	... ...	0·00
Sulphur ...	... ...	traces (10)
Loss on ignition	... ...	10·91
Ignited insoluble residue ...	...	4·08
Lime, alumina, and undetermined	...	1·75
Total	...	100·00

—*Records of the Geological Survey of India.*

SERICULTURE.

SERICULTURE IN BENGAL.

From G. N. Barlow, Esq., C.S.I., Commissioner of the Bhagulpore Division and Sonthal Pergunnahs, to the Secretary to the Government of Bengal, General Department,—No. 947 Ct., dated Camp Boalijore in Sonthal Pergunnahs, the 17th February 1883.

With reference to paragraph 11 of the Government Resolution on the General Administration Report of this Division for the year 1881-82, I have the honour to submit herewith copy of a very exhaustive report, and its enclosures, furnished by Mr. Porch, the Collector of Maldah, on the subject of silk manufacture in that district, and to state that I have nothing to add to what he has said.

2. As for the disease of the silkworms and its cure, the Deputy Commissioner of Sonthal Pergunnahs reports that tussar silkworms are subject to epidemic disease. The crop of August and September last have in many places been a failure, the young worms dying from a disease locally known as "chheruse," a form of cholera or diarrhœa which killed them in four or five days. As a prophylactic and antidote the Sonthals use the root of a plant called "chowla." The root is finely powdered and mixed with cold water. The leaves on which the worms feed are well saturated with this liquid, which is said to prevent the disease and cure the silkworms that eat the leaves so treated. Very few of those attacked recovered. The Sonthals, however, have much faith in this remedy as a preventive.

3. The Sub-Divisional Officer of Banka reports in similar terms regarding the state of the tussar worms in his district. He adds that no satisfactory cure for the disease is known.

From R. Porch, Esq., Collector of Maldah, to the Commissioner of the Bhagulpore Division,—No. 991, dated Maldah, the 2nd February 1883.

With reference to your No. 391G, dated 28th November 1882, regarding measures to prevent epidemic disease among silkworms, and the alleged decline of the Indian silk industry in consequence of such disease, I have the honour to inform you that the subject seems to have been noticed in a confused way in the General Administration Report for the Bhagulpore Division for 1881-82.

2. It is a large subject to deal with, and the following divisions of the subject must first be kept in view :—

(1.)—The Indian mulberry silk industry under the European system of reeling and supervision—

(*a*) by the English firm Watson & Co.;

(*b*) by the French firm L. Payen & Co., and the European or Western market for such silk.

(2.)—The Indian mulberry silk industry as conducted under the native system of reeling, and its market in the east ; also as to mulberry silk, the Maldah mulberry cocoons reared on the immature shrub mulberry leaf, and the Midnapore mulberry cocoons reared on the mature mulberry-tree leaf.

(3.)—Cocoons of other than mulberry silkworms, *viz.*, tussar silk cocoons, eria silk, &c.

3. As to the last, tussar, &c., though such cocoons are procurable in this district from the *boir* and other trees, and though such cocoons could be reared, no such industry could be successfully developed in Maldah side by side with, and in competition with, even the most inferior kind of mulberry silk cocoons industry, because of the superiority in every respect of the mulberry silk industry at every stage, *viz.*, growth of leaf-feeding worms, spinning cocoons, reeling the silk into thread, throwing such thread into organzine. If the alleged decline of the tussar silk industry is referred to in the letter under reply, then I may say from general enquiry that it does not appear that establishing exhibitions would benefit the tussar silk industry, for the decline is due to the hitherto rather unworkable character of the tussar cocoons. Owing to the difficulty of spinning the tussar cocoons, and the still greater difficulty of reeling the tussar cocoons for that reason, profits from this industry are low, and there are no inducements to embark or to retain capital in such an indifferent investment. The decline appears to be due to the tussar industry being commercially rather a failure, and not to any particular deterioration from disease of the tussar worm.

4. Returning to the subject of the mulberry silk industry, in which this district is greatly interested, the superior branch of it —the European supervised filature silk—this is not prospering. It is at best a very precarious industry owing to foreign causes, *viz.*, state and competition of the other foreign silk-producing centres in China and Japan, and in the European or Western silk market, aggravated at times by the demand there is for the native reeled silk (Khangru) for the local Eastern silk market, such demand being able at a profit to take up thousands of maunds of cocoons, and so to enable the native silk trade to put pressure on European firms, and send up the price of cocoons to a limit that is unprofit-

able, or just enable Europeans to keep their filatures open, unless a favourable turn in the European silk market helps them.

5. The native silk industry is prospering. Mulberry cultivation is extending. Rents for mulberry lands sub-ryoti are enormous, *viz.*, from Rs. 16 to Rs. 25 a beegha. In a khas mehal I fixed the Government rate of rent for such land at one rupee a beegha, but it was reduced by the Board of Revenue to 12 annas a beegha. In its agricultural aspects, and as regards the easy profits made by natives from the native mulberry silk industry, the industry must be considered as brisk, prosperous, flourishing.

6. Under such circumstances, inferior and deteriorating as the Bengal silkworm is, exhibitions are unlikely to bring about any benefit, because the natives interested in the trade will not accept any radical change of custom in the present state of affairs as to silk. The Bengal worm suits its circumstances; it eats little comparatively, and thrives on the immature or shrub mulberry leaf, which is renewed at every cutting; it is less troublesome in rearing, and spins often (multivoltine). The silk-thread reeled is therefore wanting in wiriness and is very endy, which makes Bengal silk, as it is, an abomination to the European silk thrower, *viz.*, preparer of organzine. The natives do not care about that, so long as the industry goes on according to custom, and they can easily raise and dispose of the frequently yielded shrub mulberry-fed cocoon, either at forced-up prices to the European silk companies, or reel it off themselves and dispose of it as a still coarser silk-thread than European Indian silk, *viz.*, the "Khangru" silk for the Bombay silk-weaving mills, and eventually for the Burmah and other markets. In Midnapore the Bengal silkworm, it seems, is fed on mulberry-tree leaf, and produces a better cocoon which gives a more wiry thread and less endy thread in reeling, owing to the mature nature of the leaf fed on by the silkworm, *viz.*, the leaf of the full-grown mulberry-tree.

7. Those engaged in the mulberry silk industry in this district understand these matters, and are wealthy enough to bring about necessary reforms in the industry, if it would pay them to do so; but any change, even if obviously advantageous, is disliked, and is suspected by the natives. They require no inducement from exhibitions for the improvement of the silk industry. With reference to the actual causes of the existing defects in this industry, it may be remarked here that from the circumstances of the country, the scantiness of fodder, the slender resources of the ryot, and the narrow area of his industrial effort, a comparatively puny breed of cattle answers his purpose better than a large, strong, and more costly stock: so, too, as regards the breed of the Bengal silkworm, with all its defects.

8. Moreover, if anything could be done in this way, the wealthy European firms, who have so great a stake in the Indian silk industry, would have worked in this way with success for the instruction of their silk gomastahs and cocoon rearers; but they have failed to alter the custom of the country, bad as it is in this respect, though they have repeatedly made such efforts.

9. The European supervised silk industry in India is a very precarious investment, but may be profitable to wealthy firms that can stem over a succession of bad years. Indian mulberry silk, from the nature of the cocoons, when reeled, is wanting in wiriness and is endy, and is hard to throw into organzine. If it could be better wound and be more wiry and less endy, the European supervised silk industry in India might hold its own against the most adverse of European markets.

10. If the European supervised silk filatures were closed, the native silk industry would still thrive for a long time, but undoubtedly such collapse would recoil upon it, and be disastrous to the native silk industry, which is so largely subsidised and indirectly guided by European capitalists. Without that capital and guidance and support, the native silk industry would, it is believed, become very precarious and collapse after a time.

11. Any glut in the native-reeled silk market, *viz.*, in the demand for Khangru silk brings down the price of the cocoons and sends the ryots with their cocoons to the European silk company's agents. There has been such a decline this year in the demand for Khangru silk, which, with the abundant yield of cocoons in the last *bundh*, has placed cocoons at a price that keeps all the European supervised filatures actively at work so far as spinners are to be had.

12. Mulberry has been this year slightly in excess of demand. No worms were lost for want of food. A little mulberry was lost through not being required. The excess of the mulberry crop was owing to the moisture from the lateness of the last rains. The last cocoons were therefore a wonderfully fine crop. There has been rather a glut in the native silk market owing to the cheapness of cocoons and other causes in previous seasons (*viz.*, over-produce, because many of the European filatures did not work owing to high prices of cocoons), and natives therefore now reel their cocoons in their small filatures at home rather than sell them. Cocoons are three rupees a maund cheaper than usual.

Native silk traders and owners of small filatures have engaged spinners; and though the European firms can get cocoons at prices that pay to manufacture silks they cannot get spinners, and so many "gains" or "basins" and reels remain unused.

13. The price of Khangru silk is from Rs. 11 to Rs. 12 per seer of 81 sicca; cocoons from Rs. 29 to Rs. 30 per maund of 80 sicca; "Chapain," or the silk refuse after reeling, sells at Rs. 50 a maund.

14. At the minimum, 12,000 maunds of cocoons are reared. Of these about 8,000 are reeled by natives and about 4,000 are reeled for the European silk companies under European supervision. The outturn is much in excess of this generally.

15. Certain letters that appeared in the *Indian Agriculturist*, in the last quarter of 1882, on this subject, appear to me to be very absurd and quite beside the mark. Rack-rents, or the high rates of rents paid for mulberry land, have not in the least affected the mulberry cultivation for the silk industry, and do not affect the question. It is a mere question of division of agricultural profits between the zemindar and the tenants of different degrees, where the estates are permanently settled. There is no restriction of mulberry cultivation affecting the silk industry. Competition rents do not prevail among sub-ryots, and rates have risen proportionate to the expansion and profits of the native silk industry. The introduction of such topics as Sunday work and immorality of the factory people in European silk factories is equally absurd and irrelevant as regards the prosperity of the industry, though the latter is much to be deprecated and put down, if it is so, in other and higher interests.

16. A copy of a report sent from this office to the Secretary of the Economic Museum, Calcutta, regarding the silk industry, of this district, No. 155, dated 6th June 1880, is herewith forwarded.

From R. PORCH, Esq., Magistrate and Collector of Maldah, to the Secretary to the Economic Museum, Calcutta,—No. 155, dated Maldah, the 6th June 1880.

I HAVE the honour to submit the following information regarding the silk industry in the district of Maldah.

2. The following published records may be referred to :—

(*a*).—The history, antiquities, topography and statistics of Eastern India, as surveyed by Dr. F. Buchanan Hamilton, (1807-1814), collated by Montgomery Martin, in three volumes, volume II, pages 959—972.

(*b*).—Report of the proceedings of the East India Company in regard to the trade, culture, and manufacture of raw silk, submitted in 1836.

(*c*).—Silk in India, compiled by J. Geoghegan (1872), section I, paragraphs 6, 27, 28, 29, 31, 32, 33, 34, 35, 36, 52, 54, &c.

(*d*).—Dr. W. W. Hunter's Statistics of Bengal, volume VII, pages 94—98, district of Maldah (1876).

(*e*)—In connection with subject. "The Wild Silk of India and the uses of tussar and other wild waste," have recently been noticed in the Secretary of State's despatch No. 104 (Statistics and Commerce), dated 11th December 1879, to the Governor-General of India in Council.

3. The following notes on the present state of the silk industry in Maldah are extracted from the Annual Administration Reports of the district of Maldah submitted by me in 1878-79 and 1879-80 to the Commissioner of the Bhagulpore Division (extract from the Annual Administration Report of the district of Maldah, 1878-79, paragraphs 18 to 26; and paragraphs 57 to 60 inclusive; extract from the Annual Administration Report of the district of Maldah, 1879-80, paragraphs 12 to 20 inclusive).

4. (1878-79) The cultivation of mulberry fared well and the crops were not far below the average. The year was very favourable as to weather for the production of cocoons, and the cocoon rearers, who had to buy more mulberry leaves than in other years owing to the abundance of silkworms, could not make the business very profitable on account of the dearness of the mulberry leaves. The dulness of the silk market has caused the closing of several large concerns conducted by European agency. The native filatures have been doing a brisk business in their coarse silk.

5. The market for silk fluctuated very much. Last season good European filature silk sold at Rs. 18 per seer of 72 sicca weight, and at the end of the season at Rs. 14 and Rs. 14-8 per seer. The native manufacturers are almost out of the Calcutta market. The natives reel an inferior coarse silk called Khangru, which is in great demand for the Bombay market. Nearly three-fourths of the cocoons reared in this district are reeled into this inferior silk in the small native filatures. It commands a uniform rate of between Rs. 11 and Rs. 13 per seer of 80 sicca weight, and the price of cocoons is regulated by the market rate for the native silk; so that European manufacturers have frequently to work at rates which leave them no margin for profit, and unfrequently they have to work at a loss (as they sell in the Calcutta and home market) and this they do simply too keep their workmen together.

6. The total quantity of cocoons reared in the Maldah district is between 38,000 and 40,000 maunds yearly; of this quantity, about 11,000 to 12,000 maunds are reeled into good silk for the Calcutta and home markets by European manufacturers, and the balance is reeled into Khangru by the natives, chiefly for the Bombay market. With regard to the quantity of cocoons, the produce per 80 sicca maunds of cocoons when reeled into good silk is on an average about 2 seers 4 chittacks of silk of 78 sicca weight. When reeled into Khangru a maund of cocoons yields nearly 2 seers 14 chittacks to 3 seers produce of 76 sicca weight.

7. The causes which affect the silk trade, and consequently the manufacture of silk, are the failure of the crop of cocoons, which is caused by extreme of heat and cold, by too much rain and cloudy weather, when the worms are in their last stage when they are spining their cocoons, and also by the want of opportune showers for the mulberry. The market for silk is generally influenced by the result of the crops in France, Italy, and China, for when the cocoon crops are good in these countries, the market for India silk is, as a rule, very bad. The Italian, French, and China cocoons are far superior in quality to the cocoons reared here, and the silk is consequently of a better quality than Indian silk, which, as a natural consequence, is not in demand when large quantities of superior French, Italian, and China silk are procurable. The only improvement in the European filatures has been the substitution of steam for boiling the water in the basins, which formerly used to be done with wood fires, as the natives still do.

8. No uniform price is ever established for the purchase of cocoons; the several different qualities sell at different prices. To be able to judge of the different qualities of cocoons, requires great

practice. The system of purchasing cocoons followed by Europeans as a rule is as follows :—

9. The gomastah at each of their factories is under a contract to supply them with silk, and to be paid for the quantity of silk reeled from the cocoons they supply, and not for the cocoons themselves. They receive orders from time to time to make silk at such and such a rate per seer, the profit and loss on the cocoon purchasers being their own. They are not bound to supply their employés with silk if they cannot manufacture it at the orders they receive from time to time, but they can almost always work to order, as the orders they receive are generally regulated by the state of the cocoon market; if the silk market is good they supply large quantities of silk and make a profit for themselves, as the orders they receive are liberal; but when the silk market is bad, these orders are restricted, so that they can only supply a small quantity, and that by picking and purchasing small quantities of cheap cocoons. Messrs. Watson and Company manufacture in this way through gomastahs who deal with the cocoon producers, but the French company, Messrs. Louis Payen, deal direct in cocoons with the ryots, and take leases of land in the mulberry-growing tracts in order to facilitate purchases of cocoons. The average price of cocoons during the season 1877-78 was about Rs. 35 per maund, and in season 1878-79 about Rs. 27 per maund. There are four kinds of refuse from cocoons, *viz.*, chassam, waste chassam (native name gudhar), cocoons that will not wind (topah,) and reel pickings (fiswa). Good chassam sold at Rs. 120 to 140 per maund in 1877-78, and at Rs. 100 to 119 per maund in 1878-79; gudhar at Rs. 30 to 33 and Rs. 28 to 24 per maund; topah at Rs. 15 to 18 and Rs. 12 to 16 per maund; fiswa at Rs. 65 to 70 and Rs. 56 to 60 per maund.

10. There are altogether six European filatures in this district, working a total of about 600 reels. Of this number, 100 are turned by steam-power, and the rest by the manual labour of boys. The total outturn of these filatures is about 480 maunds of silk yearly.

11. There have been no changes in the manufacture or mode of doing business in silk by Europeans or natives. At present the prospects of silk are very bad for European factories owing to the depressed state of the market, which has fallen of late years with each successive war in Europe. Manufacturers have no inducement for working their factories, as sales at a profit or even at cost prices are scarcely possible, while the stock of silk on manufacturers' hand is already very large.

12. Messrs. Watson and Company are manufacturers of raw or unthrown silk for sale as such in the Calcutta and the home market, and their business is entirely dependent on the market rate for raw silk. Messrs. Louis Payen and Company manufacture the raw silk in Bengal, and ship it to France for their throwing mills at Lyons; they are therefore to some extent independent of the market rate as regards the success or profit of their manufacturing operations.

13. The principal silk factories are the following :—

(1) Jalalpoor	Messrs. Watson & Co.
(2) Sadra or Gilabari ...	Ditto.
(3) Baragharia ...	Ditto.
(4) Mahodipoor ...	Ditto.
(5) Haripur	Ditto.
(6) Bholahat	Messrs. Louis Payen.

Besides the European concerns, there are numerous native silk filatures in every village throughout the mulberry-growing area of the district, *viz.*, the centre of the district.

14. The following are the different descriptions of silk pieces and silk and cotton pieces manufactured by natives at Sahapoor, Shawandai and Raipoor, and at other places in Shibgunge :—

Silk fabrics (*Garad-corah, &c.*)

1. Majlahar	Pattern.
2. Kalintaraksbya	"
3. Chandtara	"
4. Bulbul Chasam	"
5. Mayur Kanti	"
6. Dhup Chaya	"
7. Other colours	"

Silk and cotton mixed fabrics (*Ilachi masru, Siraja, &c.*)

1. Ilachi,
2. Masru ... { 1 Gulbadan. / 2 Katar of numerous patterns.

16. These are generally woven in pieces from 24 to 25 feet in length, and their value varies according to texture from Rs. 10 to Rs. 25 a piece. The raw spun silk is thrown by the weavers and others, mostly women, for weaving. Clothes suited for native wear are also largely manufactured in the district, chiefly at Shibgunge.

17. (1879-80). Mulberry is mostly cultivated in thanas English Bazar, Kaliachuak, and Shibgunge. This area greatly suffered from the flood in August 1879, and the mulberry crop then in leaf was destroyed; but after the flood had subsided, the plants revived, and the temporary injury was so far compensated as to be little felt.

18. The silk business was rather brisker than last year. Some of the silk filatures managed by English firms, that had stopped working in 1878-79 owing to the dullness of the market, were re-opened during the year 1879-80.

19. Review of silk manufacture in Maldah during the last five years.—The silk industry in the district of Maldah was about the same in 1874-75 and 1875-76. The prices of Bengal raw silk in the European market kept very steady during the years 1873-74, 1874-75, 1875-76.

20. Since the great fall of 1874, which brought down the value of European and native manufactured silk to nearly half the former price, rearers of cocoons have been complaining of losses. They no longer make the large profits of former years. They do not, however, lose when there are good crops. The losers are the mulberry cultivators, who have not a certain market now for their mulberry, owing to the smaller number of worms reared, and also owing to the failures of the worms, which of late have become very frequent. The cause of the decrease in the quantity of worms reared is thus explained. Formerly rearers, when losing their worms in two or three seasons, made such profits from cocoons in the seasons in which the worms thrived, that it more than compensated for the losses of bad seasons, and left them at the end of the year with good profits. Now the profits on good seasons are so small that they scarcely make up for the losses in bad seasons, and for this reason many rearers keep only the quantity of worms which they can feed with their home-grown mulberry without buying any from the mulberry cultivators. Some mulberry cultivators have therefore given up growing mulberry.

21. The number of families in this district whose occupation it is to rear worms may be reckoned at 20,000. They raise in the whole year about 1,20,000 maunds of cocoons, worth now about 24 lakhs of rupees. Mr. T. Price, formerly of Boroghorah Silk Factory (Messrs. Watson and Company), informed me that about 40,000 maunds are reeled in Maldah (*see last year's report*). Dr. W. W. Hunter, in the Statistical Account of Bengal (Maldah), volume VII, page 96, gives the quantity of cocoons reared at Maldah, and reeled or exported raw, as 60,000 maunds, worth about Rs. 18,60,000. From the late Mr. L. Gay of Bholahaut (Messrs. Louis, Payen and Company) and from other sources, information was obtained that the quantity of cocoons reared in the district of Maldah, and reeled or exported raw, is about 1,20,000 maunds, worth now about Rs. 24,00,000. This seems to be more correct than the previous estimates. There are about 35 square miles of land under mulberry cultivation in the centre of the district. The yearly average cost of cultivation for one beegha of land is Rs. 25, and the yearly average yield of leaves 60 *bojhas* or loads of one maund weight each, the average price of the load being 12 annas, giving Rs. 45 a beegha. This would show that the mulberry cultivator is still doing well, but unfortunately he does not always find a market for the leaf, and he has to cut it when ready all the same; this occasionally causes him loss.

22. One-seventh part of the cocoons are bought by European manufacturers; the remainder are bought either by native manufacturers, or are reeled into silk by the rearers themselves, who most of them have one or two reels. The total number of reels in this district is at least 10,000. The silk reeled by natives is sold at the Amaniganje and Sodhukapur *hauts*, and at Bholahaut *salti* or mart. It is also bought in the villages by the *dalals* or brokers. The purchasers of native silk (Khangru) are *mahajuns* from Bombay, Benares, Delhi and other up-country places. Some is bought by the corah manufacturers of Mirzapore (in the district of Moorshedabad) and Basantpore; some also is used in home manufacture for corahs, masru, and other kinds of cloths. About a century ago some seven thousand looms, and in 1810 about 4,000 looms were employed in the manufacture of these different sorts of cloths, but for several years they have been gradually disappearing. It is said that about 700 looms are now worked. The masru, which used to employ the largest number of looms, is a cloth of mixed silk and cotton, the warp being native-wound silk, and the woof a fine European made cotton.

23. There are in this district six filatures belonging to Europeans, which contain about 800 basins (gain), and give work to about 2,000 people. Men, women, and children are employed in them. Some filatures from other districts are partly provided with cocoons from Maldah during the November and March seasons, and the total amount of silk manufactured by Europeans out of Maldah cocoons is about, according to the late Mr. L. Guy of Bholahaut, 1,000 maunds or 80,000 pounds. The silk reeled by natives amounts to about 6,000 maunds or 480,000 pounds. The total number of people in this district to whom silk gives employment either by mulberry culture, worm-rearing, or silk-weaving or silk and cotton weaving, may be estimated at 300,000. The year is divided into three great "bundhs," *viz.*, crops or seasons, with small intermediate seasons as follow :—

	Species of mulberry moth.	Bombyx Mori.
November ...	Agrahani (chief) / Falgoon ...	Desi worm, Bombyx fortunatus (Chota Palu), and Bombyx Textor (Bora Palu).
March ...	Cheitre (chief) ...	Desi worm, Bombyx fortunatus, and Nistri or Madrashi worm, Bombyx crœsi.
	Bhysaki ... / Joysti ...	Nistri or Madrasi worm. Bombyx crœsi.
July ...	Asari (chief) ... / Sraban ... / Bhaduri ...	Nistri or Madrasi worm. Bombyx crœsi.

24. The manufacture of silk and silk fabrics and silk and cotton fabrics in the district of Maldah during 1877-78 was not less than in 1876-77, but at the end of 1876-77, that is, about March 1877, war between Russia and Turkey having become imminent, there was a heavy fall in the demand both in the European and Calcutta markets, and Bengal silk, which in January 1877 was selling in Calcutta at Rs. 25 and Rs. 26 a seer, fell in March to Rs. 19 and Rs. 20, being a fall of nearly 25 per cent. Since March 1877 prices remained steady up to the beginning of March 1879, when fears of a complication of European affairs caused a further fall which brought prices down to Rs. 15 to 16 a seer. The native industry, which is very large in this district, kept very steady throughout the year 1878-79, and the export of native manufactured silk and pieces was quite as large as during 1877-78, and was made, as usual, to Calcutta, Madras, Bombay, Nagpore, Allahabad, Benares, and

Delhi. The largest exports were made to Calcutta and Bombay. The native manufactured silk, called Khangru, is bought in its raw state by silk piece manufacturers from the above-named towns. The silk pieces worn in the district are corahs seven yards long by one yard wide, and are mostly shipped to Europe, where they are used for handkerchiefs, and longer pieces are used in this country for native dress (dhooties). There is also another fabric called Musra. The warp silk and woof cotton which is woven for up-country markets finds sale there only. Early in 1879 the prices of native manufactured silk were also influenced by the bad political news from Europe, but not quite to such an extent as the European-made silk. The rise and fall of price of native silk depends on the state of Indian markets more than on those of Europe.

25. During 1879-80 the "bundhs" were not good. There was a considerable failure. The cocoons that arrived at maturity were of average quality. The average price was Rs. 35 a maund of 80 sicca weight. The silk market continued much depressed owing to stagnation of business in Europe from the causes above quoted, which greatly affected the demand for silk. There was a slight improvement visible at the beginning of 1880, and prospects are now somewhat more hopeful.

26. Particulars of the best kinds of Maldah silk and mixed silk and cotton fabrics now made in the district of Maldah are entered in the two accompanying lists of 15 and of 21 specimens, forwarded in May 1880 to H. H. Locke, Esq., Secretary to the Economic Museum, Calcutta, and Secretary to the Bengal Sub-Committee for the Melbourne Exhibition, for the purpose of being sent to the Melbourne International Exhibition of 1880.

MELBOURNE INTERNATIONAL EXHIBITION, 1880.

BENGAL SUB-COMMITTEE.

Detailed list of articles sent by the Collector of Maldah, to the Bengal Sub-Committee for the Melbourne Exhibition.

Original list.	Consignor's number.	Name of articles. In English.	Name of articles. Bengali in Roman character.	Where made.	Selling price at place of production. Rs. A. P.	Length and breadth. Size Yards.	Descriptive information and general remarks.
I							
1	1	Silk dhuti, loom-cloth { Katali .. Jakwoodye .. Yellow .. }	Dhuti katali ..	In the district of Maldah, Lower Bengal, India.	9 0 0	5 × 1¼	These silk fabrics are produced from the cultivated mulberry leaf, which after cutting, is fed on by domesticated pure and hybrid worms, which in about forty days, spin cocoons, which are reeled in the native filatures and thrown by the native weavers, and the warp is stretched on a few sticks stuck up in the open air, and is thence removed to the loom, where the piece is woven.
2	2	Silk dhuti .. { Sunshine Shade or purple .. }	{ Dhuti dhupchaya or beguni		10 0 0	5 × 1¼	
3	3	Silk dhuti, peacock neck ..	Dhuti mayarkunti ..		10 8 0	5 × 1¼	
4	4	Garad dhuti, white ..	Dhuti sadagarud ..		10 0 0	5 × 1¼	The white dhuties are worn mostly by men; the coloured dhuties are worn by men, and as saries by women also.
5	5	Ditto, red, sky colour ..	Asmani ..		11 0 0	5 × 1¼	
II							
1	6	Silk than lal mojlahar piece, red repply	Than lalmajlahar ..		10 0 0	9 × 1	Nos. 6, 7, and 8 are similarly made of the native reeled silk, and are used as wrappers, like chadars, or are cut up and used by wealthy natives for chapkans or coats.
2	7	Silk than, peacock neck repply ..	Than mayar kunti majlahar		9 0 0	9 × 1	
3	0	Silk than, cheqewa repply ..	Than chouka mozabar		12 0 0	9 × 1	
III							
1	9	Silk and cotton than, white seraja ..	Than sada seraja ..		3 8 0	3¾ × 1	The silk and cotton mixed fabrics, Nos. 9-15 warp of native reeled silk and woof of European-made cotton, are made in the same way and are exported to the North-West, where various articles of attire are made from them for men and women in the North-West and in Madras.
2	10	Ditto ditto ..	Ditto ..		4 0 0	4½ + 1	
3	14	Silk and cotton than, red seraja ..	Do. lal do ..		4 8 0	4½ × 1	
4	12	Silk and cotton than, green and black, seraja.	Do. asmani do ..		4 8 0	4½ × 1	The thread is dyed, before the material is woven, with vegetable dyes.
5	13	Silk and cotton than, green katar, wavy striped.	Do. sabuj katar ..		5 8 0	9 × 1	The information given in Hunter's statistical account of Bengal, Maldah, volume VII, pages 94-98, holds good, though the industry has gone through some vicissitudes from falling market.
6	14	Silk and cotton than, red katar, wavy striped.	Do. lal do ..		5 12 0	9 × 1	
7	15	Silk and cotton than, bulbuls' eyes, viz, birds' eye.	Do. bulbul chasma ..		5 0 0	4½ × 1	

R. PORCH,
Offg. Collector.

List of silk, and silk and cotton fabrics produced in the district of Maldah, and sent by the Collector of Maldah to the Bengal Sub-Committee for the Melbourne Exhibition.

Number.	Name. English.	Name. Bengali in Roman character.	Where made.	Length and breadth. Yards.	Selling price. Rs. A. P.
Pure Silk.					
1	Woven, of twisted silk.	Pakan than ..		10 × 1¼	20 0 0
2	Eight-thread piece	Alpati „ ..		10 × 1¼	28 0 0
3	Corah undyed silk	Corah „ ..		7 × 1	6 8 0
4	Fine as air ..	Hawa chadar ..		8 × 1¼	7 8 0
Silk and cotton.					
5	Kadamphul, red flower.	Lali kadamphuli seraja.	In the district of Maldah, Lower Bengal.	4½ × 1	7 0 0
6	White kadamphul flower.	Sada kadamphuli seraja.		4½ × 1	7 0 0
7	White bee flower	Sada belphuli seraja		4½ × 1	6 0 0
8	Black striped ..	Kala patadar „		4½ × 1	6 0 0
9	Red striped ..	Lal „ „		4½ × 1	6 0 0
10	(Name of village) Sarbar seraja.	Sarbar seraja ..		4½ × 1	5 8 0
11	White large kadam flower.	Sada bara kadamphuli seraja.		4½ × 1	11 8 0
12	Fish-bone stripe seraja.	Machlikata seraja		4½ × 1	5 12 0
10	White-lined pattern.	Safedkordar „		4½ × 1	5 4 0
14	Black fish-bone stripe.	Kala Machlikata „		4½ × 1	5 4 0
15	Red-lined pattern	Lalkordar „		4½ × 1	5 12 0
16	(Name of person) Feeraji Bulbul Chasma.	Feeraji Bulbul Chasma.		4½ × 1	5 12 0
17	Fulan Sari ..	Fulan sari ..		5½ × 1¼	12 8 0
18	Without measure	Baganjisa ..		8½ × 1	5 8 0
19	Kankini ..	Kankini ..		8½ × 1	5 8 0
20	(A person's name) Mirchani Masru.	Mirchani Masru ..		9 × 1	9 12 0
21	(Pea-striped) Matru Masru.	Matru Masru ..		9 × 1	5 8 0

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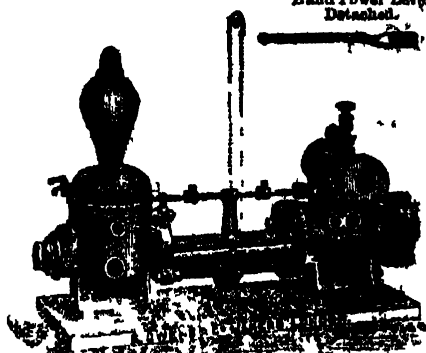
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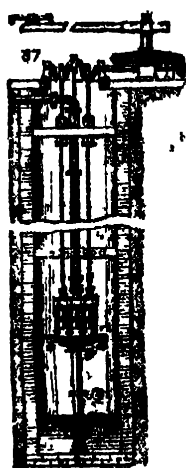
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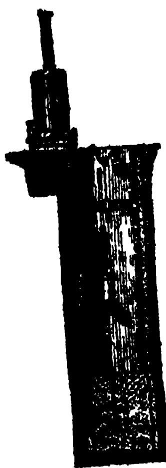
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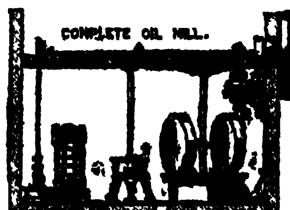


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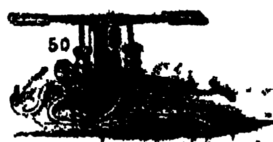

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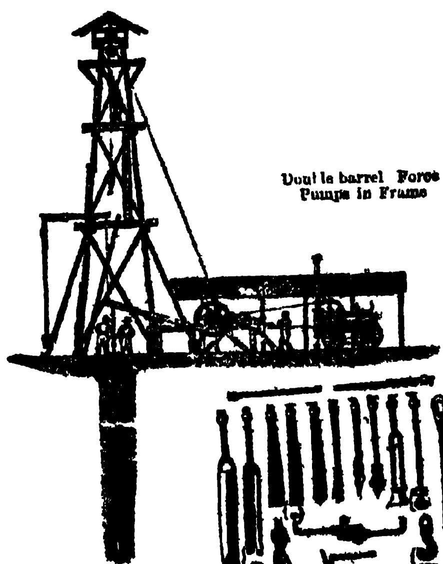


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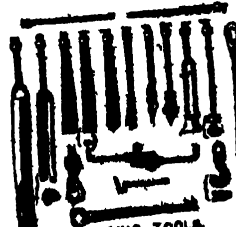

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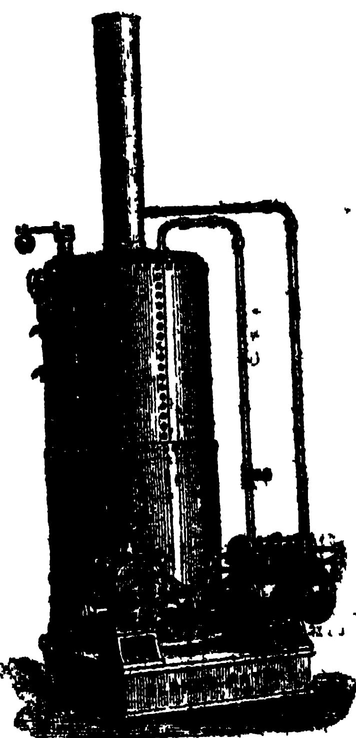

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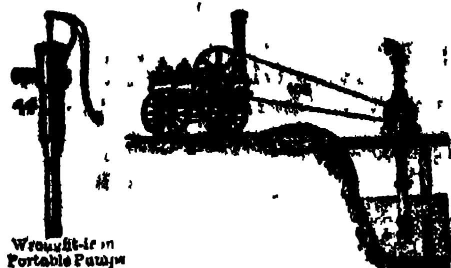

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A MONTHLY

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VOL. VIII.] CALCUTTA :—WEDNESDAY, AUGUST 1, 1883. [No. 8.

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CONTENTS :

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGMENTS.

THE Indian Forester, Vol. IX., No. 7.

THE General Report of the Survey of India 1883.

REPORT on Measurements of the Growth of Australian Teas on the Nilgiris.

CORRESPONDENCE.

THE ERGOT IN BARLEY.

TO THE EDITOR.

SIR,—The natives residing in a number of villages situated in the north of Pergunna Itmadpore of the Agra district, have been suffering this season from the most frightful sores that can be imagined. Large malignant ulcers, in which, if granulation does set in, it is of a morbid character, building above the level of the skin an exuberance that gives the sores a fungoid, poisonous appearance. It is said to appear first in the form of a pimple, and I have remarked on some portion of the leg below the knee, generally midway, or if anything rather nearer the ankle, almost invariably on the outside. The pimple if abraided forms a sore which spreads rapidly and appears to know no limit; the smallest I have seen was about an inch broad and two inches in length, boat-shaped, and situated across the leg; and the largest about five inches by three, though I am told that numerous cases are to be seen in which the whole leg is involved. I have not heard of a single cure as yet.

The disease in this epidemic form first made its appearance about the time the wheat and barley crops were being harvested, and among the poorest portion of the villagers, which gave rise among them to the most absurd explanation of its cause conceivable. The E. I. Railway line which passes through these villages is being ballasted with broken sand-stone, which gets so hot from the heat of the sun as to blister the legs of the labourers. Most of the poor people in the villages being employed on the work, and the sores often originating from these blisters, gave rise to the idea that this was the source.

The malignant and epidemic character of the disease left not the slightest doubt in my mind that it was the result of blood-poisoning of some sort, and the casual remark of a cultivator to the effect that there had been a great deal of ergot in the barley and blight in the wheat this season suggested the probable cause of the epidemic. It is well-known that the continued use of ergot as an article of food has the effect of producing what is known as "gangrenous ergotism," and other malignant diseases appearing in an epidemic form. Epidemics of this nature have been recorded to have on many occasions affected whole districts on the Continent; and I strongly suspect that the use of ergot of barley will be found to be the cause of the trouble I speak of. The kind of ergot in question is called *kândâ* in the vernacular, obviously derived from the word *kandâ*, a cow-pat, a small fragment of which fuel it resembles closely both in colour and consistency. To give you an idea of how plentiful it is this season, I send you by to-day's post for inspection a handful of it which a man collected for me from his store of barley in a few minutes. I have no doubt that maunds could be collected if necessary. Unfortunately all the barley has been threshed or rather trodden out, and I was unable to secure a perfect ear. The present specimens are only fragments, and it is a wonder, considering their texture, that they were not entirely dissipated under the heavy tread of the oxen.

In the case of the officinal ergot of rye, each grain forms a separate ergot, whereas in the present disease all the grains are agglutinated into a mass which is covered with a continuous epidermis, very thin and shiny, presenting this appearance both in the fresh and dry state; fragments of this skin will be found adhering to some of the larger pieces of ergots sent. The place where the grain should be is marked by heart-shaped protuberances. The natives are unable to account for its increase this year, and believe, or rather say that they do, that a woman or child passing a field while it is being sown, with their eyelids blackened with *kâjal* (lamp-black) will cause this blight. One old cultivator very gravely told me that this was nonsense and not to be credited, and that the true cause of *kanchea* was ploughing with a share the very day that it had returned from the blacksmith covered with black oxyde.

I have been trying to recall all unusual circumstances of the past season:—We had a very severe frost that destroyed quite half the *urhur* crop, and did some damage to the wheat, lighten-

ing the produce considerably; but this was after the grain had formed, and the ears are affected with ergot before this. But then again in the rains before this, there was a great blight of *judr* which was attacked by a grub; and to make up for the loss, hundreds of acres that would otherwise have been allowed to lie fallow, were sown with barley and sometimes wheat crops the ground had borne the previous season. This leaves room for speculation.

It is well-known that soil impregnated with the sporules of this fungous parasite will produce the disease in plants grown in it, if of the class the parasite attacks. More or less *kandua* is to be found in wheat and barley fields every year, and myriads of sporules must be scattered on them before the crops are reaped. Is it possible that the time required for a proper rotation of crops, and consequent delay of perhaps two years before the appearance of the particular crops affected by the fungus is sufficient to destroy the sporules, whereas a twelve-month is not? The greater number of the "*do fasli*" fields I have spoken about were sown with barley, being a more productive crop in poor soil than wheat; and, strange to say, it is this grain in which *kandua* is most plentiful. It is, unfortunately for them, the staple among cultivators. I sent for half-a-pound of mixed grain from the house of one of the sufferers, and though it was said to have been cleaned by his wife and ready for the hand-mill, had no difficulty in picking out small pieces of ergot, and by dusting the grain on a piece of white paper also ascertained that it was also mixed with it in a very fine powder.

The fact of the sores appearing very largely among labourers is probably due to the poor fellows being obliged to purchase flour from the *banya*, who, we may depend upon it, never bothers himself about picking the grain at all.

Wheat is, as I have mentioned, also attacked by *kandua*, but not so largely this season as barley. I send you, however, a few grains of blighted wheat, affected by the disease, also very prevalent this season, called by the natives (with a nasal pronunciation) *séhúr*—I am sorry I cannot suggest an English name.

The ear of wheat affected appears quite perfect, or if anything, rather larger than the average of the field, but contains these abortive little black grains I send you, the most peculiar feature of which, and the one by which they are readily distinguished by the natives, is the division of the top of each grain into two little points. The natives do not believe them to be poisonous, but the sickening, unpleasant taste which even one leaves if crushed between the teeth and allowed to remain in the mouth for a little while, leaves no doubt that they are mistaken, as ergot of rye is described to have just such a taste.

To conclude, if some medical gentleman would suggest an inexpensive remedy and *régime* for the sufferers I have spoken of, it would be an act of charity. It is useless to tell the majority of them to go to hospital; they are too timid, and appear to me to prefer death. I have recommended purgatives, cleanliness, linseed meal poultices, and careful picking and washing of grain before grinding.

W. C.

Court of Wards, N.-W. P.

NOTE.—The samples of wheat and barley sent by our correspondent may be seen at our office by any one interested. We should esteem it a favour, if correspondents in other districts of India will kindly take the trouble to acquaint us with disease of a similar nature affecting crops.—ED., *I. A.*

TEAK IN THE CENTRAL PROVINCES.

TO THE EDITOR.

SIR,—I have read with some surprise a notice in your issue of the 2nd July, concerning the supply of Teak available in the forests of the Central Provinces, and the necessity for introducing stringent regulations for the prevention of premature felling in those provinces.

I would ask you to give similar publicity to the following few remarks, with a view to correcting certain inaccuracies in those you have already published.

Your correspondent appears to be unaware that since 1867, no teak has been permitted to be cut except by feudatories and zemindars within the limits of their territories, without the permission of the district officer or his forest officer that the only large teak imported of late years into the Nagpore and Kamthi markets is the outcome of the Panatarau zemindari, and that its price has been from Rs. 2 to Rs. 3 per cubic foot, and not 8 to 12 annas, as stated in your issue: lastly, the statement that the Alapilli forests had been ruthlessly cut into for the supply of sleepers for the Nagpore state line. As a forest officer, who has watched the Alapilli forests for many years, I would beg most emphatically to deny that they have been damaged by cutting for this purpose. These forests have been most anxiously studied by various forest officers, including the past and present Conservators of Forests of the provinces, and the past and present Inspectors-General of Forests to the Government of India. Not more than 20 teak trees have been cut since 1875 in the Government forests. Selection fellings of *Saj* (*terminalia tomentosa*) have been most carefully carried out, and yielded a lakh and-a-half of the sleepers required.

MADRAS.

NOTE.—The remarks of our correspondent to which MADRAS takes exception were received by us as trustworthy, and accepted, as many communications of a like nature must be, on the good faith of the writer. Our correspondent will probably have something to say by-and-bye. In the meantime we are anxious to give the fullest publicity to MADRAS's letter. Our regret frequently is that the pages of the *Agriculturist* are not more frequently taken advantage of to ventilate ideas on all the subjects embraced in our journal.—ED., *I. A.*

THE INFLUENCE OF SUNHEAT ON THE SOIL AND PLANTS.

(*To the Editor of the Ceylon Observer.*)

SIR,—Mr. G. F. Walker and those who hold his convictions may be interested in the following extracts. I am with him in agreeing that we have been suffering from a want of sun-power of late years; and that it is not rainfall we have suffered from, but the long continuance of it with little or no intermission, and the absence of the requisite sunheat.

The sun of course is a most necessary factor in the consideration of climatic influence on vegetation; and no doubt the reason why (as some one remarked) one estate bears, while another does not, may in a measure arise from the power of retention or non-retention of the soil of excess of moisture. It takes a congenial season to make a *healthy* blossom!

The extracts are as follows:—"It has been calculated by Mr. Raikes, that the temperature of the soil, when drained, averages 10° higher than it does when undrained; and this is not surprising when we find that 1 lb. of water evaporated from 1,000 lb. of soil will depress the whole by 10°, owing to the latent heat which it absorbs in its conversion into vapour."

"Faraday calculated that the average amount of heat radiated in a day from the sun on each acre of earth in the latitude of London is equivalent to that which would be produced from the combustion of 13,000 lbs. of coal."

"Slightly beneath the surface of the soil in tropics, Humbolt states temperatures of 162° and 134° are frequently noted, and in white sand at Orinoco 140°, whilst at the Cape of Good Hope under the soil of a bulb garden a temperature of 150°, is recorded by Herschell. In China the temperature of water of the fields was found to be by Meyer 113°, and adjacent sand much hotter. These extremes of temperature would cause the specific gravity of the air to vary from 1167 to 863 may serve as a kind of measure of the disturbing causes which interfere with the velocity and local direction of atmospheric currents and other phenomena, the calculation of which has been founded on mean results."

It would be a good thing if certain stations were with sunshine recorders, but perhaps their cost would be against their institution. Earth thermometers however are moderate in price, and are made to go as deep as 120 inches. There can be no doubt that the temperature of the ground greatly affects that which is growing on or in it.—Yours faithfully,

J. V. H. OWEN.

The Indian Agriculturist.

CALCUTTA, AUGUST 1, 1883.

THE *PIONEER* AND THE *INDIAN AGRICULTURIST.*

OUR Allahabad contemporary says that it is "perplexed with doubts as to the trustworthiness of the *Indian Agriculturist* on a subject so well within its province as manure." The *Pioneer* is modest enough to admit that these doubts do not arise from a more intimate acquaintance with Indian agriculture than is enjoyed by the *Indian Agriculutrist.* This perplexity, on the part of our contemporary, has arisen, it seems, from "some very positive assertions," recently made by the *Indian Agriculturist,* and the conclusions arrived at by Dr. Voelcker in a late number of the Journal of the Royal Agricultural Society. The *Pioneer's* perplexity of doubts seems to us to arise from the confounding as identical two things, which are totally different. These are—*first,* the value of nitrogenous manures; and *second,* the validity of the conclusions drawn by Mr. Fuller from experiments made on the Cawnpore Experimental Farm. We need scarcely say that we have never at any time under-estimated the value of nitrogenous manures. Our ideas regarding manures in general and their classification may, we think, be fairly gathered from several articles which appeared in this journal in the year 1879, and one of which the Government deemed of sufficient value to reproduce in the *Gazette.* To have a due appreciation of the value of manure is one thing; to question the sweeping conclusions drawn from a few experiments is another, and a totally different thing. The *Pioneer's* perplexity appears to us to consist in crediting us with unbelief in the efficacy of ammoniacal manures, when we really neither hold nor express such unbelief, but in reality venture to withhold our assent to conclusions which seem to us to be based on an insufficient substratum of experiment. It would not be difficult to show that we are not alone in believing that the deductions made from the Cawnpore experiments cannot be accepted without considerable limitation. We venture to reproduce the following extract of a letter which appeared in our columns on March 1st, 1883. The writer is Mr. C. A. Hill, B.Sc., F.C.S., Associate of the Royal School of Mines:—

"Mr. Fuller has committed the mistake in inductive logic of basing a wide generalization upon a very limited breadth of experience. His remarks may be understood to imply that in all Indian soils, and for all crops, nitrogenous manures are the most valuable; whereas, all that may be legitimately inferred from his admirably conducted experiments, is that *on the experimental plots of the Cawnpore farm, in their present condition,* the manure most required *for a wheat crop is* a nitrogenous one—the manure most required for a different crop on the same ground, or for wheat in another part of India, might be a very different one."

No one, we suppose nowadays, who knows anything of the science of agriculture, would venture to assert that nitrogen, and nitrogen alone, is all that is required in the matter of manure to render every field fertile and every crop a bumper. Some such belief did certainly prevail thirty or more years ago, but, as we ventured to say, the craze for nitrogenous manures died away when their true relative value came to be understood. In reviewing the Cawnpore Farm Experiments, 1881-82, we said: "Comparative experiments have everywhere proved that the use of any one fertiliser, whether nitrogen in any of its forms, or lime, potash, phosphoric acid, or salts, has always produced conflicting results, indicating, as a disturbing cause, the presence, in different proportions in the fields experimented upon, of some available plant-constituent or constituents which the fertiliser assisted the plants in absorbing. It follows that the repeated use of a given fertiliser (as proposed for nitrogen by the Assistant Director of Agriculture) must progressively impoverish the soil of the co-active constituents sooner or later, and reduce the outturn of the crops to nothing. Mr. Fuller's experiments have not embraced this feature of the case, or he would not have over-rated nitrogen, essential though it is to plant economy. That *no one plant-constituent is of any value in the soil by itself,* and that several contribute to make up a plant, is a cardinal axiom that should never be lost sight of. The Cawnpore experiments conclusively establish this. An *unmanured* soil (page 288 of the *Government Gazette,* already quoted) yielded 771lbs. of wheat per acre. The same soil, fertilised with nitrate of potash at 240lbs. to the acre, yielded 1,605lbs. Difference in produce—834lbs. Another *unmanured* soil yielded 777lbs. per acre, and when similarly nitrated, produced 1,242lbs.—difference in yield, 465lbs. If nitrogen is all that Indian soils need, explanation of the disparity in yield of the nitrated plots is necessary. The two *unmanured* soils, it is worthy of note, were in the present instance in identical conditions for experiment. There was a difference of *only 6lbs. per acre* in their *unmanured* yield; yet, when nitrated, one field yielded 369lbs. per acre more than the other! There is but one explanation of this. One field had more assimilable plant-constituents awaiting excitation with activity by nitrogen than the other; and the conclusion that follows is, that *something besides nitrogen* is needed for Indian soil."

We trust we have, so far made our position sufficiently clear with regard to the criticism which we ventured to make on the conclusions arrived at from the Cawnpore Experiments. In replying to a leader in the *Pioneer* (we think), which was based on the January articles of the *Indian Agriculturist,* Mr. Fuller in a letter to the *Pioneer* shielded himself behind the authority of M. G. Ville. We have not his letter before us, and write from memory only; but so far as we recollect, he affirmed that his experiments were carried out on the lines marked out by M. Ville, whose work he very properly stated had been crowned with all the honours which scientific societies could confer on them. M. Ville's work was published in 1879, and translated and edited by Mr. Crookes, F.R.S. In the pages of the *Agricultural Gazette* for January 1883, Sir J. B. Lawes subjects M. Ville's statements to a destructive criticism, from which it is very doubtful whether the reputation of M. Ville will ever recover. We do not blame Mr. Fuller for bringing to his support all the authorities he can muster, but in the instance quoted he has been unfortunate. In closing a long article dealing with the series of articles written by Sir J. B. Lawes for the *Agricultural Gazette,* the *Field* says:—"As regards the important question as to the sources of the nitrogen of plants, M. Ville's statements as to the power of plants to derive a portion of their supplies directly from the air is blown to the winds by a mass of facts, the result of actual experiments. M. Ville states that nitrogen is assimilated by plants in three different forms, *viz.,* as ammonia, as the nitrate of some base, and as nitrogen gas: and that it has been ascertained that 'crops always contain more nitrogen than the manures supplied to them, and this excess is derived not from the soil, but from the air.' Such a positive statement is proved by Sir J. B. Lawes to be absolutely erroneous in every instance. Wheat most nearly, of all our cultivated crops, accounts for the nitrogen supplied in manure. In every other instance where excess of nitrogen above that contained in the manure is said to be derived from the atmosphere, the very opposite is the fact—the manure contains more nitrogen than appears in the crop, and a considerable loss occurs. In the analysis of the soil in which his experiments were carried out, though *made with the greatest* care, no mention is made of nitrogen, but he refers to it as similar to that of Rothamsted as to the nitrogenous matter. Sir J. B. Lawes states that within reach of agricultural crops, the arable soil contains from 10,000lbs. to 12,000lbs. of nitrogen per acre, but apparently M. Ville leaves this out of calculation altogether; and, because he finds more nitrogen in certain crops than was applied in the manure, jumps to the conclusion that the balance was derived directly from the air. In the case of wheat—which, as has been shown, makes the best use of the nitrogen supplied—it is shown by the reviewer that 1 cwt. nitrate of soda furnishes 17lbs. or 18lbs. of nitrogen, and that if every particle were taken up this would suffice for 11 bushels

of extra wheat, and he thinks farmers would be satisfied with 6 bushels on an average, and that even in 1863, the year of maximum produce at Rothamsted, the amount of nitrogen in the increase of the experimental crop was considerably less than that supplied in the manure. * * * * Sir J. B. Lawes points out many other errors which our limits will not allow us to recognise. Enough has been advanced to act as a warning to our readers not to blindly follow the advice of one who, however well-intentioned, is not a farmer, nor a scientific man, but who is evidently profoundly ignorant of agricultural practice."

Mr. Fuller has mentioned M. Ville as the man in whose footsteps he has followed, and now the *Pioneer* brings forward Dr. Voelcker as the eminent authority who "bears out with extraordinary force the results of the Cawnpore experiments."

The *Pioneer* will probably be surprised to learn that the experiments of Dr. Voelcker which it brings forward in confirmation of the Cawnpore experiments not only reveal nothing new which was not established beyond all possibility of doubt many years ago, but are merely confirmations of an earlier experiment. Sir J. B. Lawes, then Mr. Lawes, more than thirty years ago conducted the following experiment :—

Two plots of land, side by side, for eighteen years were manured alternately with ammonia salts and phosphate of lime. In 1852, plot No. 1 was treated with ammonia, plot No. 2 received superphosphate. In 1853, No. 1 got superphosphate, and No. 2 ammonia; and so on for eighteen years. Thus, each plot had been nine times manured with ammonia and nine times with mineral phosphates. Over the whole time the average produce of both was exactly the same, 24⅝ bushels; but the average of the eighteen crops grown by mineral manure alone, whether on plots No. 1 or No. 2 was only 17¾ bushels; whilst the average of the eighteen crops grown on either plot by ammonia salts was 31⅝ bushels, being an increase of nearly 14 bushels per acre more each year. These results, confirmed by Voelcker, and tested by the practice of agriculturists, were accepted among scientific agriculturists long before Mr. Fuller's interesting experiments in the same direction were thought of. The *Pioneer* will probably now understand why we could see nothing astonishing in the Cawnpore Experimental Farm experiments, and why we do not feel at all annihilated by Dr. Voelcker's paper in the *Journal of the Royal Agricultural Society*. Dr. Voelcker is but following in the footsteps of Lawes, and the latter left nothing to be performed by those who came after him but confirm what he had established.

The chief source, however, of the *Pioneer's* perplexity arises from the "grave discrepancies between some very positive assertions recently made in the *Indian Agriculturist*, and the conclusions arrived at by Dr. Voelcker . . . which bear out with extraordinary force the results of the Cawnpore Farm experiments and the conclusions which we drew from them," and the writer in the *Pioneer* "doubts whether the *Indian Agriculturist* will find it worth while to quarrel with so high an authority as Dr. Voelcker." Here, again, it seems to us there is confusion of thought, and a consequent inability to grasp the points at issue. So far as we are aware, no one doubts that both at Cawnpore and Woburn, the yield of wheat from nitrogenous manures was very marked. Had Dr. Voelcker, however, gone on, as Mr. Fuller has done for India, to draw from the Woburn experiments the conclusion that it is nitrogen alone that is deficient in the soil of England, not only would the *Indian Agriculturist* have "quarrelled with so high an authority," but every scientific agriculturist in England would have laughed in the doctor's face.

We may be permitted here to say a few words anent the criticism which the *Pioneer* recently made on an article of ours regarding the appointment of Major Pitcher. In our June number, we said, "We have no knowledge whatever of Major Pitcher. He may be the most suitable man in all India for the position he has been placed in at Cawnpore; but this square-man-round-hole business of placing soldiers and warrior judges, in charge of Experimental Farms, seems to us about as wise as placing ploughmen and pig-drivers in command of regiments, and giving district and divisional commands to growers of big cabbages, superlative turnips, and gigantic gooseberries." The *Pioneer* was then good enough to vouch for the superlative fitness of Major Pitcher. He had specially studied agriculture during a recent furlough to England, and was out of sight the best man in the province for the position. Will the *Pioneer* inform us if there is any country in the world besides India where the servants of the State are asked to perform such widely differing duties, demanding special knowledge, as that implied in the translation of a Small Cause Court Judge to the practical control of a scientific Experimental Farm? So far as we are aware, the control of Experimental Farms is given in England and the Colonies, Germany, France, America, and elsewhere, to men who have made a life's study of the subject, or who have been specially trained for the purpose. In India, a clever civilian or a clever military man is deemed able to cope with anything—from the demarkation of a ryot's holding to the government of a province, and the idea never seems to dawn on those who make such amazing appointments, that the purposes of the State would be better served by importing men from England—young men who have studied agriculture in theory and practice in the best schools of Europe and America. The Bengal Government is about to establish an Experimental Farm. Will there in this case also be a clever civilian appointed, or will the Bengal Government look for a man of ripe experience who will redeem Indian Experimental Farm reports from a good deal of twaddle?

The *Pioneer* has been good enough on several occasions in recent years to criticise and lecture the *Indian Agriculturist*. May we take the present opportunity of returning the *Pioneer's* compliments? We strongly advise our contemporary to write about subjects which it understands, and leave to journals such as the *Indian Agriculturist* the discussion of technical topics which lie outside the rim not only of the *Pioneer's* knowledge, but which apparently stand beyond even the circumference of its conceptions.

NOTE ON THE CAUSES RETARDING IMPROVEMENT IN CATTLE-BREEDING AMONG CULTIVATORS OF THE HINDU CLASS IN THE DOAB TRACT, ABOUT THE VICINITY OF DISTRICT ETAH, N.-W. P.

THERE appears to be a great deal of something not quite comprehensible in connection with cattle-breeding among Hindoo cultivators about this part of the country; not speaking of professional breeders, but of the great mass of agricultural people. The male of the cow species furnishes the draught server in agriculture, and the female of the buffalo species the milk supply; the opposite sexes on either side being comparatively useless except for propagation, and it would seem reasonable that before a proper means could be devised for improving either or both of these species, that we should form, if possible, a correct appreciation of the causes and of the effect, whether detrimental or otherwise, of these exclusions on the general conditions of the animals.

A cultivator in these densely cultivated districts, if asked why he does not keep a greater number of cows and breed his own draught cattle, invariably answers that it is because he has no grazing grounds. Reflecting no further than that this is a fact, many have been led to the conclusion that there is some inherent infirmity in the constitution of the cow that renders it impossible for her to exist without grazing on a pasture, this not being the case with the buffalo. The buffalo in the matter of grazing has, if anything, the advantage over the cow of habitually grazing at night, and of grazing in a pouring rain, and perhaps of protecting itself from flies, a serious obstacle to grazing, by covering itself with a coating of mud. Whether these advantages are admissible as such or not does not alter the fact—that there are no perceptible physiological reasons why the cow should need to graze and not the buffalo. That the cultivator will keep buffalo cows but not cows unless he has pasturage for them, is a fact, but some other reason must be assigned for it, the most plausible being that as stall-feeding is much more expensive than grazing, it does not pay to stall-feed cows.

The first fact that is always thrown in your teeth by cultivators of these parts when urged to increase their stock of cows is, that the buffalo averages a supply of three times as much milk as the cow—6 seers against her three ; but as it is well known that the milking qualities can be bred and improved, that English cows, when properly fed give an average of 12 quarts—quite 12 seers, and that many country cows have been, and can be brought to give the same, the inference is that she is neglected. Large milk-giving capacity is obviously as much an artificial condition in the cow as the length of fore-arm and other peculiar physical conformations that give the English race-horse the speed he shows. The great development of udder and lean condition that characterizes the first-class milch-cow in working trim is a form obviously quite unsuited to any animal in a wild state, dependent chiefly on speed for its preservation as most of the herbivora are, and judging from this, any approximation to this state must be a retrogression from good milking qualities. Allowing cattle to graze in large herds with the object of securing bull calves which are allowed to suck their dams as often as nature prompts is, it is to be feared, an approximation to the wild state, and most of the breeding in India is done in this way.

An interesting enquiry now remains, which is—why it is that the she-buffalo has supplanted the common cow in the dairy of the Doab Hindoo cultivator ? Supplanted she has been. Setting aside other weighty reasons, it is traditional that the general use of the milch-buffalo is comparatively recent, and it is well known to be extending. However unexpected the conclusion may be, it is strongly suspected that the veneration in which she is held by Hindoos has had a great deal to do with bringing about her degeneration. The first objection to keeping a cow by Hindoos may have been the fear of her getting into the clutches of beef-eating people when these people ruled the land ; and it will not be surprising if the first impulse to buffalo-breeding proves to have been given during the time of the Mahomedan conquests. This, in the absence of proof to the contrary, hardly admits of doubt. To this day, despite the relaxation in Hindoo religious discipline, it is deemed a disreputable act to sell a cow at all, and decidedly improper and sinful to sell her to people likely to devour her, or desecrate her sacred person in any way, and we can readily imagine how glad the conquered Hindoo must have been to find a substitute in the buffalo, regarding which animal there are no such scruples. There can be no doubt that foraging parties from large Mahomedan armies secured their beef by force, it being highly improbable that till a very late period they could have purchased enough for their wants with Hindooism at its height ; to say nothing of their early policy, which was by no means one of even religious toleration.

2. The very important question of gelding to which no one appears to have laid much weight.—No Hindoo about these parts would dream of emasculating an ox; even a *chamar*, in this part of the country at all events, would be instantly outcasted did he attempt it, for we know of an instance where this was actually done, though the man kept up the trade in spite of the disgrace. But at the same time, no cultivator would care to yoke one that had not been so treated ; besides the docility and lessened liability to constitutional waste secured, there is a tacit conviction, only very occasionally expressed, that the unsexed beast has lost its sanctity, and that whatever objection there is to working the entire bull, there is none in harassing the unfortunate "budiya," as the gelt animal is called. Can we conceive anything more deleterious to cattle-breeding and disadvantageous to agriculturists than this objection to castrating ? The ordinary cultivator now, unless he wishes to release a "Brahminy Bull" after the death of a relative, is bound to sell his bull calves, and under most disadvantageous conditions for he must have budiyas. The few that do use entire bulls, nevertheless bred by themselves, make a great merit of it as manifesting their devotion to their religion, and carefully fix a plank across the horns. You are occasionally told that So-and-so owns a bull as docile as a gelt ox; but these exceptions only prove the rule, and the sad truth is that the majority get more dreadfully vicious, and are sold to the "banjara dealers" for a mere song, if not presented to them, on condition that they will catch the beasts themselves. A party of Banjaras were observed a few days ago near the tehsil town of Itmadpore in the Agra District, driving away a number of mature bulls that they had evidently purchased from cultivators who had kept them entire in the hope that they would prove docile. The poor beasts had been subjected to the excessively cruel process of castration, known as "crushing," and were being forced to march before the inflammation, which is always very great in this process, had subsided. "Incision" does not appear to suit mature bulls, and the small liability to tetanus displayed in the bovine species allows of the crushing process being carried on with impunity ; in the horse, it frequently results in tetanus. It was probably the intention of these men to dispose of the animals in large cities for heavy cart work, as late castration never ensures a perfect temper. The operation of gelding is always performed by the first year in the case of cattle required for light, active work, as most well-bred animals are ; it lightens the neck and shoulders. The heavy neck being a sexual sign is only acquired at maturity, and it is only cattle that are required for heavy, plodding work, that are allowed to acquire something of this form before being castrated. After the second year and before the third, must be the time in this case. Both well and plough work are best performed by active animals, and cultivators, when wishing to praise their cattle tell you, that they "actually *jump down* the bullock-rim" or "*fly* with the plough." The value of a bull-calf decreases every day after the proper time for castration has expired, and the shortness of this period, combined with the absence of a competitive mart, leaves very little hope of a good bargain being made by the Hindoo cultivator.

This objection to rendering the animals serviceable, on which they are dependent for so much, can only be regarded as a great social evil among these people. Everybody knows that you must have gelded oxen, that the bulk of the animals must be purchased from Hindoos, yet they refuse to geld, and there must be no ostentatious sale and a large seasoning of sophistication even with the ungelt animals. Your respectable Hindoo should not go dancing about a mart—who will buy ?—with his cows and calves : they should be sold at home, if at all, with pretence of the sale being really a gift, and a respectable native will often tell you with pride that a cow has never been sold from the stalls of his family within the memory of man ; you may sell to the *chamar* and he to the gelders if he is not over-anxious about his soul ; then you may buy "budiyas," but not the particular ones bred by you, This would be indecent, and you would be throwing yourself open to suspicion. Your brother may buy such animals but it is considered an uncanny thing to do. The banjara who castrates is the customer ; he is oftener a Hindoo than a Mahomedan, and it is pleasant to deceive yourself with the reflection that you sell to a Hindoo. This, almost the only, legal customer belonging to a vast clique, can demand his own price for entire bull-calves. They are now with the cultivator of such a wretched breed that he scarcely offers anything for them : Rs. 10 is about the average. The banjara gets his stock from breeders in well known districts, but if a cultivator purchasing draught cattle from him, happens to have a male calf, it is sure to be thrown into the bargain at a dead loss. Bound to be of a vile breed, it is, after castration, sold to some unfortunate *chamar*. Taking all this into consideration, it does not appear astonishing that a cultivator should show no anxiety to improve his own breed, and that he should neglect the splendid opportunities offered him by Government of well-bred bulls. One would think that the best inducement to general improvement would be the guarantee, if possible to private breeders of a fair price for their entire bull-calves of a certain standard. Perhaps it would then pay to stall-feed cows of better quality, and the objection of "want of pasturage" would not be raised so frequently.

The writer knows of an instance in which a beautiful black Hissar bull, one of a number furnished by the Awah Estate under the Court of Wards, was scarcely tolerated for the first few months of his being stationed and advertized free of charge for the use of all cows brought to him, and is now flocked to by cultivators, it is confidently believed, because the Agricultural Department have begun to give prizes for cattle at fairs. The bull has been about 20 months at one depôt, and is now the sire of 73 beautiful calves, 57 of them males and more

peculiar still, all black like him. The owners of a few of them being told that they could compete for prizes at the Batesar fair appeared pleased, but remained quiet, it is suspected, because they are poor men, and weigh the chances of taking a prize against the expense of travelling, to say nothing of neglecting their *rabi* crops, as the fair takes place in November, their being no reasonable hope of their selling the entire calves to advantage. They were asked what they thought of selling their calves, with two teeth, to Government for artillery purposes, and, of course expressed their approval and opinion that it would pay to visit the fair under these circumstances. The Government demand for oxen for military purposes is very large, and there should be no difficulty in giving a guarantee for the demand, particularly when a very superior standard could be fixed. They could be purchased entire at about 2½ years, and castrated. The late gelding would leave their necks rather heavy, but perhaps this is just the form wanted, for the heavy draught work they are put to. There can be no doubt that this would throw a fair share of the trade into the hands of cultivators, in whose interest we write, and by making them regular cattle-dealers, perhaps eventually induce them to throw aside scruples about castration. After all, the objection is very weak and unsound in a religious point of view. A brahmin was asked to explain how, if castration was so sinful, he reconciled himself to purchasing gelt cattle, his moral responsibility as purchaser being just as great as if he had performed the operation himself, inasmuch as if he did not make the demand, it would not be the interest of dealers to geld. He could only answer that it was not the practice, and added that there were some otherwise orthodox Hindoos who went so far as to sell their calves to castraters, and then purchase them back for a slightly larger sum, really the gelding fee, but that they only did it because it has been the practice in their families for ages. The best cattle for general use about this district are brought from the Mearut country. The Merati is a Mahomedan, and has no scruples about castrating. The Jat also, unless living among scrupulous people, is not very particular in this matter, and breeds good cattle. There is reason to be afraid that no breeder could make the business pay if he objected to geld his own stock unless specially supported.

3. *Food.*—In the case of a buffalo-cow every particle of waste food and leavings in a Hindoo household can be utilized, but not so with the cow: it would not be proper to feed her on leavings of food—*jhuta.* The imperfect digestion of the horse in comparison to that of ruminants, allows of the dung of the former being given freely to the buffalo with the effect of fattening and increasing milk: the only objection being, the horse odour, which can be detected in the milk. Low-caste natives do not hesitate to feed their cows on it as well, and it is apparently not considered as objectionable as *jhuta.* The few people, well-to-do cultivators, respectable Kaiths, &c., that do keep a cow or two, the smaller the better as they will eat less, say that they only do it so as to be able to perform certain religious ceremonies with facility, and that if it were only a matter of milk it would only be more profitable to keep a goat. The object is to salute the beast, and look at her face the first thing in the morning. Give her a little of their food before eating themselves, (a meritorious act) secure "products" for the purification of their hearths, &c.

The buffalo is said to have the superior advantage of being able to eat certain cheap fodders that the cow will not; we know of none in daily use. The cow does not refuse castor, neem, babul and jharberi—the four extraordinary fodders used about here. We do not do natives sufficient justice when we imagine that they cannot calculate on the niceties of agricultural economy. The following is what a shrewed Kaith, who by the way owns a cow, told us: "there is one little advantage that the keeping of a cow should be credited with. If in grazing about it enter a field of corn, there is a chance of the cultivator saying, 'It is a cow, let it eat,' but heaven protect the buffalo detected at any similar little game."

On the whole, I should not think that the buffalo has any very superior advantage under this head; perhaps what is meant is, that coarse food gives more profitable results in the case of the buffalo than it does in that of the cow, in the matter of milk.

4. The buffalo is said to last longer than the cow, and a common native proverb is,—

Gai dusra dhori, bhains tisra thori. This, when literally translated, means—that while the cow is aging after her second calf, the buffalo is scarcely affected by her third calf. Of course, the numbers here are exaggerations but it shows the prevailing impression. It is understood to be an established fact that the better fed an animal is the more virility will it show, and if the unfortunate cow is to depend upon "usar" pastures for its support, the origin of the proverb is not long to be sought for.

5. There are religious objections to selling a cow, but none whatever to selling a buffalo, and one can understand a poor but pious Hindoo cultivator who knows that he may be forced to sell his milch beast any time, selecting the buffalo.

6. A buffalo proving barren does not throw a cultivator so completely off his centre if we may use the expression, as in the case of a cow, the latter would prove a burden as it would not be easy to get rid of her while the former can and will certainly be put to the plough or yoked to the well rope. From the superior attention paid to her, she shows more bulk and bone than the average male buffalo, and makes a very fair draught animal. A short time ago we came across a cultivator working a barren cow-buffalo, at a well; it appears that he had worked her for 6 years. He originally trained her, influenced by the idea prevailing in these parts that work sometimes removes sterility. As she did not improve but worked very well, he continued working her. The usual thing is to make the barren cow-buffalo over to the carrier who loads and works her freely returning her when she shows signs of recovery, if she ever does. A large proportion of the buffaloes that may be seen carrying grain to the Agra market of a morning, will be found to be barren females.

7. If a Hindoo kills a buffalo accidentally, it does not matter in the least as it does in the case of the cow, when he has to perform penance of no ordinary severity. In fact, he compromises himself rather seriously if he allows her to die with a rope round her neck, and tethers are carefully removed from cows believed to be dying. Thakurs sacrifice a buffalo to the godess *Kali* at the *Dessehara* festival.

8. The bull buffalo as a draught animal for agricultural purposes holds a very inferior rank, bad for well work, for he is slow and cannot bear the heat of the sun. Bad for ploughing because he will not walk straight, and it is not easy to make a clean, straight, furrow with a pair. What is generally done is to pair a buffalo and an ox: the ox keeps the buffalo straight, and they manage to get along pretty well. Even this is objected to very strongly in a proverb that we cannot do better than give—

Bhainsā bard ka khētī karā, karua kār birāno khāé, Badiya ainchat hāé bhūran ko, Bhainsā khench dehar ko jāé, aur jékar ghar mé nār karkeā vo nar binā maut mar jāe; Or—He that ploughs with a buffalo-bull and an ox will know (bitter) debt, for the ox will draw up towards the dry sand and the buffalo will drag down towards the swamp; and he that has a shrew for a wife will die before his time.

Of course only *chamars* and such low castes use them for ploughing and irrigating, though all classes use them for carts. We were once given, by a cultivator, a very lucid illustration of this tendency in the buffalo not to walk straight. He unyoked a pair of oxen, and they immediately started off unattended for a clump of trees where the were daily tethered and fed. He then unyoked a pair of buffaloes, and they as soon commenced straggling about in opposite directions as if unaware of the existence of the trees where they were also daily attended to, and had to be pushed and punished into the proper direction. Perhaps, through the stupidity of the beast, it is not possible to train it so thoroughly as the ox.

Natives have a proverb to the effect that you should not count on your buffalo till the calf has weathered three winters, showing that the mortality among them till they arrive at maturity is considered great, but it must be the same with the male produce of all milch stock, particularly where they

are of scarcely any value. Buffalo-calves are said, however, to be very susceptible to cold. Nor can very young animals endure the hot wind and at this time of the year they are found to thrive best in an enclosed room the floor of which has been flooded and worked up into a puddle; the steaming atmosphere of such a place suiting their temperament. Male calves are hardly allowed enough food to keep them alive; it cannot be afforded when the milk which they require is more valuable than the calf itself. The latter sells for about 4 rupees when 18 months old, and the very buttermilk it would have required in this time to keep it in health is worth more, let alone the butter which the cultivator cannot afford to eat himself. In the bovine species the rule does not admit of exception that the male is naturally larger than the female, and the reverse being the case with the ordinary breed of buffaloes about here, the conclusion is that it is the result of unnatural starvation. Natives tell you that they cannot keep up a suitable breed without refreshing by importation of stock from localities where the animal thrives best. It is very likely that the neglect of the males of the home stock, already spoken of, partially accounts for this necessity, though we must not lose sight of climatic unsuitability, the natural habitat of the buffalo being a moist warm climate. A well informed and experienced English gentleman who has resided in the part of the country between and about Agra and Delhi for more than 30 years, tells us that efforts were made in days gone by, to introduce the huge Bengal buffalo, but without success, and that the breed known as the "Sindhi" recognized by their great size and more especially by their twisted horns, which like that of a ram form quite a ring, have always proved superior and best suited to the locality. The famous milk buffaloes of the "gaddis" or Mahomedan milkmen of Aligarh are said to be of this breed. They have the reputation of being very careful about the breed of their cattle, and to be very chary about parting with good males bred for milk stock.

9. Buffalo milk is said by the natives to have a greater specific gravity than cows' milk, and to be in consequence more satisfying food, and at the same time to contain more butter; but then they tell you that the quantity of butter in the milk of a buffalo-cow, though averaging 6 per cent by weight, is as much subject to regulation as the produce of a field. Feeding on cotton-seed immediately increases the butter per seer of milk, though at the same time it reduces the quantity of milk, but the balance of profit is universally admitted to be on the side of cotton-seed feeding, if for no other reason than that it is easier to extract butter from rich milk, and the animal keeps in better condition. Natives here say that feeding on the grain called *urd* has the peculiar effect of producing an inordinate flow of milk in the buffalo that ruins her in a very short space of time, and that it is a favourite trick with dishonest people that wish to sell her to advantage. It is only suspected at present that if there is any difference between the specific gravity of the milk of the cow and buffalo, it is the result of difference in bulk, and that the same difference would be found between the milk of very large and very small cows. It is an open question. In short, one is led to believe that this advantage, if such it is, possessed by the buffalo over the cow, is also the result of neglect and consequent degeneration in the latter.

There can be no doubt that investigation would elicit other points of difference between the two species that would show advantages and disadvantages in each; but those mentioned seem the most important, and would appear to justify the following conclusions:—

That the ordinary Hindoo cultivator finds it more to his advantage to keep milch buffaloes than milch cows. The reason for this does not appear to be because the cow is constitutionally unsuited to bear comparison with the buffalo in milking qualities, but because religious feelings brought about a neglect of the cow that resulted in her degeneration. That these feelings still influence the Hindoo, and have organized a condition of pecuniary loss in bull-breeding among cultivators which as the bull furnishes the draught power in agriculture, represents a needless loss in this industry. That unless things are modified and the prospects of gain enhanced, the neglect will continue.

That the encouragement of a competitive demand under conditions that do not compromise the Hindoo with his society, accompanied with aid in the shape of well-bred sires, and if possible, a guaranteed demand for good steers,—in fact, means taken to ensure a profit to the breeder although he cannot command a cheap pasture for his stock, will, as in the case of horse-breeding, ensure the improvement of cattle among agriculturists, and throw a profitable industry into their hands, particularly if the cow can be brought to rear good bull-calves, and furnish as much milk as the buffalo at the same time.

That though the buffalo being an exotic animal is likely to die out very readily if the above end is obtained, she now holds the place of the milch beast admirably, and taking religious prejudices and all things into consideration, her improvement is worthy the consideration of those who would aid the ryot, the greater part of whose rent she now pays, her keep, as has been often pointed out, representing an annual profit of Rs. 40 *to a cultivator of 10 acres of good land*, who is enabled through her to utilise certain productions of his fields that would otherwise be wasted.

That nothing but the ordinary idea of supplying good animals for sires, and discouraging breeding from any others, appears to be wanted for the improvement of buffaloes, they being so much in vogue: unless a demand could be found for good males, indispensable animals for draught and burden in marshy districts.

W. C.

OUR WEATHER OFFICE.

A GOVERNMENT whose financial prosperity and very existence depend on direct income from the land, may appropriately subsidise science in the pursuit of weather-laws —these intimately affecting the prosperity of the agricultural masses. And it is well that the solution of a great problem has been undertaken in India as elsewhere by State resources, which alone can make success possible. For some years past the Government in this country have responded liberally to the ever-increasing demands of the Meteerological Department for expansion. The operations now extend over an area which must be the envy of European meteorologists, and the compactness of its administration is doubtless an element of efficiency. That it should seek to justify its existence in attempts to forecast the weather is commendable, while in conformity with natural expectation of the due exercise of the functions with which it has been presumably endowed.

Unfortunately, here, as elsewhere, the fluctuations of a column of mercury, representing variation in air-pressure or tension, have received undue prominence: and are held to comprise the secret of long-sought weather laws. Degrees of tension, however, have no known or recognisable sequence, and wanting this knowledge and much else, forecasts as now constituted must usually prove illusory. Occasional conformity between forecast and weather proves nothing—furnishes no weather law—for weather-casts, avowedly empirical, score as many successes as those emanating from highly organised State departments, equipped with costly appliances and invested with scientific *eclat*.

The telegraph has been employed here, as in Europe and America, to announce the periodical and season weather changes, which, first manifesting themselves in known confines, extend over large and varying areas—but this operation scarcely comes within the domain of predictions. The area' intensity, and duration of weather-phases (the *ultima thule* of meteorology) are not details which the telegraph can determine. No forecast, for instance, of the probable duration, intensity, direction, and limit of the air-depressions, *alias* rain or monsoon currents, which appear at intervals on the Bengal and Bombay currents, and travel into the continent of India' is possible by the telegraph. But such information accompanying the intimation of the appearance of the depressions would be valuable to the agriculturist. Of course, it would be still more valuable to be informed in advance by the weather office when and where these depressions would form, and the area they would affect. As with those monsoon depressions,

however, so with the American storms which are alleged to traverse the Atlantic. Not always do these reach England or France. They frequently end somewhere on the ocean. The weather office fails to give any information in this respect; it is helplessly confined to telegraphic intimation of storms having commenced in certain American localities, whence they are hypothetically held to cross the Atlantic to Europe. It is not by any means established that all Atlantic storms originate in America, or that any storm so originating has actually been traced to England and France. What is suggested by the knowledge obtained is a probable co-incidence at times between disturbances gradually extending over vast and varying areas. The practical worth of the weather office in Europe and America, as in India, in fact begins and ends with the telegraph which is not a meteorological instrument at all.

It is true that the weather office in England claims the fulfilment of 80 per cent of its predictions, but departmental statistics, departmentally interpreted, are not necessarily contributions to eternal verities. In India, for instance, the secretariat conclusions from jail and police statistics often conflict with departmental deductions, and tone down considerably departmental self-satisfaction. But any deduction, however authoritative and entitled to respect, must be vitiated if all the factors in a question have not been tabulated. Some years ago the head of the Medical department in England declared that departmental statistics proved the health of the Indian army to have been strikingly benefited by recently improved sanitation. The jubilation among the official constellations was however brief. An Assistant-Surgeon suggested that the diminution of mortality and sickness was rather the outcome of increased *invaliding*—a factor that had found no expression in head-quarter statistics.

The 80 per cent confirmations claimed by the weather office in England must be appraised by their character, as well as by the character of the 20 per cent failures. The last presumably comprise the unexpected incidence of great storms which inflict severe losses on the mercantile community. The department has not on the other hand been able to establish to the satisfaction of anybody but itself, any diminution of shipwrecks and consequent loss of life, or of any benefit to agriculture or to the population at large, through its alleged triumphs. No aid given by the telegraph in estimating the *direction*, for instance, of a storm already in incidence at a distance, is a meteorological prediction for the localities warned to prepare for it. Still less are pretensions to a prediction in such cases admissible when neither the duration nor distribution of intensity is notified. There is no basis to proceed upon in these respects. And when we bear in mind that in England weather phases, unlike those in India, are comparatively of brief duration, it is always likely that a prediction during a period of disturbance, of the cessation of that disturbance within a certain number of hours, will be verified —even when not scientifically based—and the same for deductions as to duration of calms according to season. The bulk of the 80 per cent verifications consist of such triumphs, the scientific premises in which are more or less contestable, while the conclusions are endorsed, as it were, by a cynicism of nature. The public estimate is adjusted accordingly. Again —the alarm through hoisting of cones and other signals on erroneous deductions from telegraphic and other data, makes the community eventually distrustful or indifferent to warnings unless confirmed by local weather knowledge assisted or not by instruments. This is very natural; for the loss of time which means loss of money in a commercial and maritime country through concessions to miscalled science, must ultimately create contempt of efforts, however scientific the alleged basis.

On a par with the above, but on a vague and still less tangible basis are the speculations by our Indian weather office on the character of an approaching "rains." To predict for instance, an average, or more or less than average "rains," conveys no information of any value to the almost purely agricultural population, while confirmation can scarcely suggest suggest a scientific triumph. The area of prediction in Bengal, N.-W. P., Central Provinces, and Punjab is rarely, if even without sufficient rain, except over varying fractions of it; and the definition of average, or above or below average "rains," is one that the agriculturist is indifferent about, provided the distribution of rain over the season has been opportune or satisfactory. The practical value of a prediction is embraced just in these points—and on them the weather office is silent. A "rains" may be above the average—but a rainfall concentrated in July and August signifies drought when the *rabi* crop is to be sown, and *that* in turn implies a famine due within a twelve-month. A "rains" may be below the average, but its distribution so adapted to agricultural requirements as to ensure an ample *kharif* crop and the foundation of the *rabi* or succeeding one. And so on for other conditions. Under these circumstances the only prediction that would prove striking or vindicate science, would be that of total or almost total failure of the "rains;" *area being mentioned*. But the weather office has no knowledge of area; a prominent feature of this year's prediction too. Again, the forecast of a more than average "rains" this year for the Bengal, N.-W. P., Central Provinces and Punjab, cannot possibly imply that a uniform fall of so many inches will occur in each subordinate area with a known rainfall average registered at certain stations. The distribution of the rain is always eccentric. Large tracts may be deluged while others be imperfectly visited, or not have more than an average rainfall. So far then as details of area are concerned, a consideration that supersedes everything else, the prediction, even if confirmed as to the gross area, will be a failure.

Of late a tendency has been manifested in our Indian weather office to enlist phenomena in certain localities, for determining weather phases in contiguous areas—a significant admission that weather laws may be sought for elsewhere than in the fluctuations of the barometrical column. In June last, the office concealed its barometrical prediction of the preceding May, of an "early rains" in Upper India. An unexpected snowfall in the Himalayas at the end of May was held to have vitiated the forecast. Such a phenomenon in previous years had, it was declared, retarded the "rains" through lowering the temperature in Upper India—or in other words causing there a rise in pressure. Monsoons like all disturbances gravitate only to areas of low pressure—which is the same thing as high temperature. On subsequent discovery, however, that the snowfall of May was only partial and that through not extending into the interior of the Himalayas, the requirements of departmental hypothesis of a retarding high temperature or low pressure had not been satisfied, the original prediction of an "early rains" in Upper India was restored. But the supposed inter-dependance of phenomena more or less separated by time or locality or both has never been justified by facts. That the weather office is, however, pledged to some such hypothesis is further proved by the following :—

"Weather report, Simla, 19th June 1883. * * A dry westerly and north-westerly current prevails over North-Western India, apparently *repelling the moister monsoon current.*"

Here hypothesis seeks in co-incidental phenomena the relation of cause and effect. But even then what justification is there for preferentially making the westerly and north-westerly current a *cause* in this instance? How if the monsoon current repelled the other? That the dry area referred to was as much the effect of the atmospherical regulation at the time as the moist area beyond it, and that the dry and moist winds were simply concomitant features of the weather noticed there is not consonant with science at the weather office, because meteorological hypothesis has ever sought to discover *at the earth's surface*, the origin of weather-phases. The spectacle presented to the mind's eye of moist and dry winds contending for mastery, is as unscientific in conception as false in fact. At no point was there any conflict of winds in the instance mentioned, for the result would have been something of a cyclone. What happened was that each body of wind diminished in force towards a neutral area of calm of more or less extent, on reaching the confines of which it ceased. The phenomena is of constant incidence; during the "rains" more prominently than at other times. The hills offer the best facilities for observation. Flying scuds or clouds in masses of some extent from

the S.-E., or S.-W., travelling at the rate of 6 feet and more per second, may be seen dissolving or vanishing about a limit which the spectator may approximately determine by observation against the contour of a distant ridge. Whatever the force of the wind density or volume of the clouds, the latter will be found to travel very little beyond the point at which their dissolution is observed to commence. This will go on for an hour or more when the invisible cloud-vanishing line will recede or advance. But this forward or backward movement of the area of moisture by no means suggests repulsion by an invisible force, or repulsion of the latter. It is simply a self-adjustment to altering atmospherical conditions. As the wind is part and parcel of the phenomena, it presumably ceases too at about the cloud-vanishing line aforesaid. That wind and cloud are inter-dependent on atmospherical movements involving both, as in the above case, a noteworthy instance may be quoted. At day-break once on a sultry morning in an open agricultural tract, a rushing sound in the west drew attention to a low bank of clouds stretching unbroken from north to south (as far as the eye could see) and advancing rapidly. As it passed over-head, a brisk wind sprung up. The wind ceased as the cloud sped onward. But the rushing sound that was audible for some time after, proved that the wind was confined to the limits of the cloud, which was about 400 yards wide. The limits of the moist and dry areas and winds referred to by the weather office on the 9th June aforesaid, were similarly not regulated by conflicting winds, but by the operation of some occult atmospherical conditions which are always arranging areas of visible and invisible weather-phases.

There is demonstrable error in constituting barometrical variations and so called inter-dependant phenomena, the basis of forecasts. These are irreconcileable. In the *Pioneer* of the 18th June, an article, entitled "The Monsoon," desires to establish that the abnormal deviations of the barometer for March, April, and May last, serve as an index of the ensuing "rains." These deviations represent excesses or deficiencies over average pressure (masking influences being eliminated) for the months in question. Excesses are termed *positive* or *plus*; deficiencies *negative* or *minus*. The first indicate an approaching "rains" *below*, the second *above* the average. Now either this hypothesis for an ensuing "rains" is right, or that of inter-dependant phenomena. They cannot both be correct—for if positive and negative pressure are repressions or forecasts at all, it is not a matter of the remotest consequence what the character of Himalayan snowfalls is. The "rains" can neither be retarded nor accelerated, nor otherwise affected by them. But if snowfalls do have any such influence, then positive and negative pressure are meaningless. It is noteworthy that the department rates pressure somewhat low in assigning a vitiating influence over it by snowfalls. It therein perpetrates a scientific heresy, which although practically worthless is all the same welcome because degrading the much vaunted barometer.

The theory of abnormal pressures, however, requires examination on its own merits. If the abnormal pressures of March to May do not indicate *current* atmospherical conditions, but those for June to September, what do the abnormal pressures of these months signify? Logically, the weather for subsequent months—and not the "rains." But as the abnormal pressures for March to May were negative, a more than average "rains" will follow. Such a "rains," however, is impossible without the abnormal pressure during their incidence being also negative. It cannot possibly happen that the pressure during the "rains" will be positive, and the rainfall nevertheless conform itself to the negative or low pressure of March to May. Supposing however, that the relation between the pressure of March to May and that of the "rains" is established, then the undeniable inter-dependance of the "rain" with the "rains" pressure leads to the fact that the "rains" pressure is virtually indicated by the pressure of March to May. And this being the case, analogous relation of the October to December pressure with the "rains" pressure will be established; and so on all round the year. In other words, the abnormal pressure of March to May last which started into existence somehow, will be permanently transmitted from season to season in succeeding years—thus making one year a counterpart of the other for all time to come, and rendering a weather office unnecessary—a logical *harri-karri* truly.

The abnormal pressure deviations of any period and locality, can refer only to that period and locality, and as it is an established fact that low pressure means high temperature and low temperature high pressure, the abnormally low pressure of March to May last was accordingly attended by abnormally high temperature, and the known inter-relation of pressure and temperature was thereby exceptionally illustrated—that is all. The weather office is doubtless justified in seeking a connection between preceding and succeeding weather-phases, because given conditions and their environments are necessarily the resultants of antecedent ones, but all the factors must be known for a reliable deduction. At present *pressure* constitutes the sole basis of inference. That all the factors required by present hypothesis will be discovered or determined is a possibility (of the remote future) but that satisfactory deductions from them will be practicable deductions rising to the dignity of laws, is not clear. It might prove more profitable to seek the origin of atmospherical laws in influences beyond the earth's surface, than in interminable combinations of factors of varying number and strength.

A. P. W.

THE SUPERIORITY OF INDIAN WHEAT.

MESSRS. McDOUGAL BROTHERS, of Mark-lane, London, have furnished the Secretary of State for India with a very interesting report of a series of experiments with Indian wheat, which they were instructed to carry out. Four lots of Indian wheat, each of 5,000lbs., were delivered to the firm, and the following instructions were laid down for their guidance in conducting the experiments. The instructions were —(1) that they should take a given quantity of wheat of each of these four representative Indian wheats,—*viz.*, Indian fine soft white, Indian superior soft red, Indian average hard white, Indian average hard red —and manufacture them into flour by the ordinary process of grinding under millstones; that they should take similar quantities of the same wheats and manufacture them into flour by means of crushing between rollers, according to the system known as the Hungarian or roller system; (2) that a given quantity of each flour so produced should be manufactured into bread; (3) that the qualities and other characteristics of the flours produced, also of the offals, *viz.*, middlings, pollard, and brand, should be noted; and (4) that they should procure the following representative wheats, of fair average quality of the season, as then being sold in Mark-lane Market, and for the purpose of obtaining results for comparison, deal with them precisely as above indicated, both as regards flour, bread, and offals, *viz.* —English average, American (red winter), American (spring), Australian average, Californian average, Russian Saxonska, Russian Taganrag, Russian Kubanka, Russian Ghirka, Egyptian Bubi, and Egyptian Saida.

The experiments, we observe, were carried out in the firm's own mills, and were personally superintended by one of the members of the firm, a fact which goes no little way in adding to the value and trustworthiness of the report. The results attained have undoubtedly proved the superiority of the four lots of Indian wheat over the English and foreign wheats; and we cannot do better than state here for the benefit of our readers the leading characteristics of these wheats, as given by the firm itself in its report to the Secretary of State. We take the Indian wheats first.

Lot I.—Quality, fine soft white wheat —(white, medium sized, skin thin, clean and regular, free from seeds; 2 per cent weevilled; handled exceedingly well.) Value in London, 49s. per 496 lbs. Weight per bushel, 64 lbs. (This weight is only equalled by specially fine samples of any wheat.) Weight of 100 separate grains of the wheat, 55·4 grains avoirdupois. (100 weevilled grains weighed only 39·69 grains avoirdupois.) Results of the milling and bakings prove it to be an exceedingly good and useful wheat; the flour being great in quantity, of pure white

color and superior bloom, and with a slight beany flavour. It is more suitable for markets requiring *white* flours rather than strength, owing to its containing an exceptionally low percentage of gluten. The yield of bread from it is very large.

Lot 2.—Quality, superior soft red wheat. (Colour, dull light brown, with about 5 per cent white wheat; size, half-medium and half-small; skin thin; weevil, only a trace; clean and free from seed; handled well.) Value in London, 45*s.* per 496lbs. Weight per bushel, 62¾ lbs.; weight of 100 separate grains of the wheat, 51·8 grains avoirdupois. Results of the millings and bakings prove it is a good and useful wheat; the flour being great in quantity and of medium colour and strength, with a slight beany flavour, and containing an average of gluten. Suitable for markets requiring flours of medium strength and colour. The yield of bread is exceptionally large.

Lot 3.—Quality, average hard white wheat (colour, light yellow, and semi-transparent with a little hard red; size, long and arched; skin thin; wheat clean, but about 3 per cent of dry mud in large pieces; weevil only a trace). Value in London 44*s.* per 496lbs. Weight per bushel, 60lbs.; weight of 100 separate grains of the wheat, 68·3 grains avoirdupois. Results of the milling and bakings prove it is a useful wheat for markets requiring strength; flavour, beany; the gluten (by water test) averaging 12 per cent. This wheat and No. 4 are probably unsurpassed by any other wheats in the world as regards the quantity of flour yielded. In colour, medium. Specially useful for mixing with very damp English wheats to bring them into condition for milling. It is also a profitable wheat for millers, owing to its requiring 8·4 per cent water to render it sufficiently mellow for use. To this wheat and to the Indian average hard red (lot 4) must be awarded the distinction of *producing more bread than any other flour*, making it a "baker's" flour as well as a "miller's." The yield of the bread is exceptionally large.

Lot 4.—Quality, average hard red wheat. Colour, very dull brown, semi-transparent, with 10 per cent fine, soft, white, large, coarse grains, arched and pointed. Value in London, 43*s.* per 496lbs. Weight per bushel, 61¼lbs. (condition clean and free from dirt, but a little grain, seed, and linseed and barley; free from weevil.) Weight of 100 separated grains of the wheat, 77·7 grains avoirdupois. Results of the milling and bakings prove that it produces a common and dry strong flour, in almost unequalled quantity. In colour it is inferior. It is profitable wheat for millers, as it takes 7·6 per cent water to render it sufficiently mellow for use. The yield of bread is exceptionally large, making it a "baker's" flour as well as a "miller's." The same remarks apply to this as to lot 3.

Glancing at the results obtained with the English and foreign wheats, we find that the yield from the English wheat was poor, that from the Russian Taganroy good, and from the American spring and Russian Saxonska medium. The highest yields were obtained from the Australian, Californian and American red winter varieties, but even these were far behind the yield obtained from the Indian wheats. The two Egyptian varieties experimented with were apparently very inferior, the Saida being described as the poorest wheat in the market, possessing no good qualities and not nearly worth its price.

Two systems of milling were adopted in carrying out the experiments. That of grinding under millstones is said to produce flour of one "run" or quality, and does not offer facilities for the production of flours of high, medium, and low grades from the same wheat. By the grinding system some of the outer skin or bran is also torn or ground into flour, so preventing the attainment of perfection of colour. It is said to be well adapted, however, for the production of common ordinary flours, as it produces a greater quantity of flour than a system which more thoroughly separates the offals. By the roller system, flour is produced by flattening or squeezing the grain through a series of rollers, as distinguished from the tearing or grinding of millstones. The system is described further as follows:—"The wheat is first cracked through a first set of rolls and its sieve, so separating a small quantity of flour and dirt, the latter being liberated out of the crease of the wheat, and is not removable by any system of brushing or blowing. The cracked and purified wheat is then passed on through other sets of rolls and sieves, and rendered into middlings and flour." A leading feature in this system which deserves notice is, that the germ of the wheat in which is the chief portion of the colouring matter of the grain, is not torn or ground into flour as it is by the system of grinding under stones, but the action of the rollers is to squeeze or flatten it, and from its soft and oleaginous nature, to increase its size, so rendering its separation from the flour easy. The advantages of this system are said to be, less liability to "kill" or destroy the granular nature of the flour, the removal of the dirt found in the creases of the wheat, and the separation of the germ, so rendering the attainment possible of a high standard in the character, colour, and bloom of the flour.

It is satisfactory to find Messrs. McDougall Brothers recording their opinion that the character and general excellence of the Indian wheats are improving with the deliveries of each successive season. Speaking of the particular consignments they have been experimenting with, the firm say, "that the Indian wheats now specially under review were delivered to us in excellent condition, with freedom from dirt (except lot 3), barley, gram, and other impurities, also with a freedom from weevil, rarely equalled by Indian wheats, except the prime parcels of the past season, and there is no doubt an outlet in this country and the European continent for unlimited quantities at prices that shall prove remunerative to all parties concerned, either in their growth, transportation, or conversion into flour and bread."

FORESTS IN ASSAM.

THE area of Government forests in Assam at the end of the year 1881-82 was 8,011 square miles, made up as follows:—

Reserved forests	...	2,066 square miles.
Protected „	...	659 „
Other „	...	2,799 „
Forests beyond revenue limits ...	...	2,487 „

The additions of the year were three new forests aggregating 50 square miles, which were brought on to the list of reserves. We observe that the question of bringing under reserves several other forests is under consideration, and it is perhaps probable that more work in this direction will be effected during the current year.

The results of fire protection during the year under notice do not appear to have been very satisfactory. Out of an area attempted of 105,212 acres, the failures amounted to 42,785 acres, or 41 per cent. The fires occurred chiefly in Goalpara and the Khasi Hills, where the injury done is reported to have been great. It is stated, however, that measures have been taken which will prevent the recurrence of such damage in the forests near Shillong, and it is hoped that similar precautions will be adopted in regard to the valuable sal forests of Goalpara.

Breaches of forest rules were not numerous during the year, and in this respect Assam compares very favorably with other provinces. The number of prosecutions was 37, against 40 in the preceding year. The majority of the prosecutions were on account of illegal appropriation of forest produce.

The area under plantations at the end of the year was 1,151 acres, as against 1,107 acres at the end of 1880-81. The total area was distributed in the following proportion:—

Caoutchouc plantations	...	912 acres.
Teak „	...	170 „
Other „	...	31 „
Sowings of Nahor and Ajhar	...	38 „

The teak plantations at Kulsi and India-rubber at Balipara are reported to be progressing favorably. A very large number of the rubber trees at Balipara are now over 9 feet in height, and by constant care and attention they have been protected from injury. The licenses given during the year to extract rubber from the district forests, which were sold by auction, realised an income of Rs. 26,846. Some of the licenses are reported to have realised immense profits, in spite of the competition of foreign rubber, and of the facility with which the trees can be tapped in any part and the produce sold as foreign. Besides the Balipara plantation, there are a number of old rubber trees in the Chandwar reserve on which experimental tappings are to be made to ascertain what amount of juice can be safely

extracted, the age at which tapping can be begun, and the effects on a tree of judicious tapping.

It is stated that little forest work has yet been done in the districts of Sibsagor, Lukhimpore and Cachar. On this point the Chief Commissioner remarks as follows in his resolution in the Forest Report:—" The timber trade has not yet extended up the Brahmaputra Valley higher than Gowhatty, and there is little local demand for any other woods than the common kind. A new demand for sleepers has, however, set in through the construction of the Dibrugurh-Makum Railway and the Jorehat Tramway, and in the Lukhimpore district 4,377 trees were handed over to the railway, which has a concession for five years of all timber it requires. The royalty on these, had they been sold to the public, would have amounted to Rs. 18,410." The exploration of the large and little known tracts which it is proposed to reserve on the slopes of the Naga Hills, around Makum, and in the north Cachar Hills, was the principal work done in these districts during the year under report.

The departmental timber operations show a decline during the year. The total number of trees felled by the department was 378 as against 599 in the previous year. Besides these, 6,112 trees were felled by purchasers, and 4,377 trees were made over free of charge to the Assam Railway and Trading Company. The financial results of the year have not been satisfactory. The receipts amounted to Rs. 1,66,053 as against Rs. 1,68,997 in 1880-81 and the expenditure was Rs. 1,65,361, against Rs. 1,42,725 in the preceding year.

CANAL ARBORICULTURE.

THE report of District and Canal Arboriculture in the Punjab for the year 1881-82, shows that a fair measure of success was attained in the operations of that period. The length of avenues planted by district committees during the year was 380 miles, making the total length planted to the end of 1881-82 up to 4,008 miles. The extension of groves, nurseries, and plantations was also satisfactory; the total planted area for the whole province at the end of 1881-82 stood at 3,437 acres, as against 2,802 acres in the preceding year. Compared with 1880-81, the financial results of the year show a slight improvement; the expenditure amounted to Rs. 1,07,886, against Rs. 1,05,695 in 1880-81, and the revenue derived was Rs. 35,478, or Rs. 5,603 better than it was in the preceding year.

There seem to have been several methods adopted in the raising of trees. The general rule is that of raising them in nurseries, and transplanting them when they are from one to three years old. In the Delhi division, the tehsildars, it is said, adopt the method of sowing the seed in trenches; another plan adopted is that of sowing the seed on raised embankments; in Rohtuk, again, the plan of setting out root-cuttings in worked earth was tried with success. It is satisfactory to learn that the efforts of the authorities to secure the interest of leading members of the agricultural community in arboriculture have not been wholly unsuccessful. In the Sialkote district, it is said that the people have already done much both in arboriculture and horticulture, while in Hazara the demand which is growing up for trees, which are distributed gratis, is taken as a sign of appreciation of arboriculture on the part of the natives.

Turning now to the actual work of the year, we see that the introduction and cultivation of vines and good fruit trees received much attention in Sialkote, Jhung, Dehra Ghazi Khan, and in one or two other districts. An attempt is also to be made to introduce the better kinds of plantains into the Punjab, where the present variety grown is a very poor one. In the Hoshiarpore district a new encamping ground was laid out at Damsuah; and very much was also done in planting out *nara*, *munj*, and *kahi* grass for the purposes of protecting roadway embankments. The work in connection with reclaiming the " Cho" near Hoshiarpore was also continued, and according to the report, the results hoped for are " protection to certain low-lying mohullas of the town from floods, and the diversion of the channel of ' Cho,' which, if unchecked, threatens the existence of the town." In the Jhung district there are now a very large number of kikar plantations which supply wood for river steamers. These plantations are the property of zemindars, and we see a proposal in the report for purchasing some of the better plantations from their owners, in view to planting them out with shishum instead. From Delhi, Hissar, Jullundur, and Peshawur the reports of the work done during the year are also satisfactory.

As regards canal arboriculture, we see that the total length of avenues, as it stood at the end of the year, was 2,045 miles, against 1,949 miles in the beginning of the year. The financial results were satisfactory. The expenditure amounted to Rs. 32,541, and the income derived was Rs. 46,392. Speaking of the work done by the canal authorities, the Punjab Government's resolution, reviewing the report, says that " a large number of trees were planted on the Kasur and Sobraon branches of the Baree Doab Canal, and on the new distributaries of the Western Jumna Canal; and now that water has been turned into the Sirhind Canal, arboricultural operations will be prosecuted more vigorously along its banks."

EDITORIAL NOTES.

WE owe to the courtesy of the Lieutenant-Governor a copy of a letter which he has addressed to the Government of India, on the subject of the establishment of an Agricultural Department in Bengal. The letter is itself highly interesting and instructive, and the proposals set forth have a decidedly practical aspect. We are unable to comment upon it in the present number, but our readers may see it reviewed in the *Statesman* of the 25th and 27th ultimo.

MR. D. MORRIS, the Director of Public Gardens, Jamaica, at the request of the Government, recently visited British Honduras to examine the flora and agricultural resources of the colony. The following is his preliminary report:—

" With regard to my visit to British Honduras, I was enabled, by the assistance and courtesy of the Government, to travel through all the southern settlements: and while making observations and carrying out the wishes of the local Government, I had very favourable opportunities, (assisted by the native collector whom I took with me) to make valuable collections of seeds and plants for the Public Gardens of this island. The chief plants of interest gathered were several species of Palms (Chamædoreas, Bactris Sabal, Chamærops, &c.,) which were not previously in the Jamaica Gardens: seeds of numerous timber trees and flowering plants: and a valuable collection of decorative orchids, including the indigenous large growing Vanilla of Central America. This latter has pods much larger and more aromatic than the ordinary Vanilla cultivated in Jamaica, and I am hopeful that it will be largely propagated and distributed in the island.

" After returning from the south, I next visited the central and western districts of the colony. This country generally (with the exception of a few isolated ranges) rises so very gradually from the sea coast to the interior that points on the western frontier, nearly one hundred miles from the coast, are only three hundred feet high. This low, gently-sloping land, is plentifully intersected by deep navigable rivers which flow slowly towards the sea. Along the banks of these rivers, the characteristics of the soil and climate were of a most favorable character, and the vegetation essentially tropical and luxuriant. Passing across the country from the river district to another, a section was traversed composed of a poor quartzy soil supporting only a sparse vegetation of Pine (Pitch Pine), evergreen oaks, and a low shrubby palm (Chamærops sp). On further acquaintance with the interior portions of the country I found that the alluvial deposits along the river banks extending some five or six, or, in some instances, some ten miles on each side, contained, chiefly, the rich valuable soils of the colony. Beyond these were ' broken lands ' and ' pine ridges.' I estimate that fully one-third of the area of the colony is composed of ' pine ridge.'

"The most important as well as the richest river valley in the colony is that of the Old River, sometimes called the Belize river. This extends in a wide sinuous course from the town

of Belize at the sea coast to the western frontier : in the upper portions, the valley widens into broad expanses of rich fertile plains covered by cohune palm, in some cases, thirty or forty miles in breadth. I carefully examined this district and worked my way to the frontier station—the Cayo—near which a coffee plantation has recently been established. With the exception of some six sugar estates and the same number of banana plantations, this coffee plantation is the only attempt, hitherto made, to establish a systematic course of culture in the colony—the bulk of the people being employed, and the chief trade of the colony depending upon mahogany and logwood cutting, which, when good prices are ruling, are apparently very remunerative industries.

"In the forests of the western districts, I found the rubber-tree of Central America (Castilloa elastica) very abundant. This tree (a member of the Breadfruit family) is specially suitable for cultivation on account of its preferring a loamy sandy soil ; and being a deep feeder it might be utilized as a shade tree in cultivated areas with great advantage. I spent two days with a rubber gatherer in order to observe the methods of bleeding the trees and preparing the rubber : and I brought with me botanical specimens of the tree, some seed, as well as a sample of the rubber. I hope soon to make a special report on this tree and its produce. I am, also, making arrangements to procure a large quantity of the seed, when ripe, for distribution amongst cacao planters in this island. Trees at ten years old yield from four to seven pounds of rubber, which is valued at from 2*s.* 3*d.* to 3*s.* per pound. If carefully managed, the trees can be bled every three or four years.

"Another interesting plant found wild in these forests was the indigenous cacao of Central America : this differed from all kinds I had met previously. After careful inquiry, I found that it was the 'Tampasco cacao' of the Atlantic slopes and identical with the celebrated 'Socunusco' of the Pacific coast. In habit and character, the trees approach those of the *Cacao Criollo*, and an examination of the pods which are of a golden-yellow colour led me to the conclusion that this 'Tampasco' or 'Socunusco' cacao is the yellow form of the celebrated 'Caracas' cacao. Should such prove to be the case, there is little doubt that this yellow variety will prove as much superior to the red (Caracas) form, as the yellow Forastera does to the red (Trinidad) cacao.

"Many other interesting plants of timber and dye-woods, as well as of plants of medicinal and economic value, were met, many of which I have no doubt are capable of being utilized both in British Honduras and in other British possessions. A detailed account of these will more fittingly be included in a report which I am now preparing on the scientific result of my visit.

"In returning from British Honduras, as mentioned in the second paragraph of this letter, I had to take steamer to New Orleans, and I was detained there nine days waiting for a steamer for Jamaica. I took advantage of this opportunity to visit the sugar estates on the river Mississippi; and among other kinds, I found that the celebrated Lahina cane of the Sandwich Islands (lately introduced to Jamaica from Mauritius) was under cultivation on one estate and was very favourably reported upon. I brought with me specimens of the best canes from Louisiana which have been safely established at the Hope Plantation.

"The best Louisiana sugar-canes are as follow :—

"*Lahina Cane* : brought from Sandwich Islands by Dr. Richardson and cultivated at Belair Plantation on the Mississippi River. Reported upon favourably by John Dymond, the proprietor : small flag : grows well and yields good sugar : does not, however, ratoon well. See Mr. Horne's Report on the same cane received from Mauritius last year.

"*Louisiana Otaheite Cane* ; formerly much grown in the Southern United States, now mostly superseded by the Red Ribbon and Violet canes : it does not stand the climate of Louisiana so well as either of the latter ; comes up later ; matures later, and ratoons less well. In favourable (*i.e.*, warm) seasons or under favourable conditions (*i.e.*, near the sea or bank of rivers), it produces larger tonnage than either Ribbon or Violet canes, but is rarely so sweet as either. It is a tender cane for these latitudes, and easily affected by frosts.

"*Red Ribbon Cane.*—The sweet Louisiana cane : hard shell, broad leaf : a general favourite amongst planters, but is reputed without sufficient grounds to degenerate into the red cane : yields largely in quantity of cane and works well into sugar : does not stand frost so well as the violet cane, but is, on the whole, considered the best cane for Louisiana.

"*Java Cane.*—Very similar to Otaheite : was brought to Louisiana about 1870. Stands frost better than the ribbon cane and ratoons well. Said to be a rich cane, yielding sugar largely."

In a paper read at the last annual meeting of the New York Agricultural Society, H. E. Alvord summarises the conclusions thus far obtained upon the subject of silos and ensilage : Silos of moderate size are convenient and economical on almost any farm, to preserve green any forage crop which circumstances prevent curing, or some crop specially grown to supply succulent food in the winter. Silos may be built with much less expense than has been generally supposed, and that, upon their location and arrangement, the economy of their use very largely depends. This system of storing forage may be pursued almost regardless of weather, and may be arranged so that the chief labor comes at a time when other farm work is not particularly pressing. With proper care the process of ensiloing will preserve green forage substantially unimpaired as food, but with a probable increase in the percentage of protein and more or less loss in the carbhydrates. As cattle food, ensilage forms a cheap substitute for roots ; but the crops generally used fail to fill the place of the root crop in a judicious farm rotation. In feeding ensilage, the best results follow a moderate system, rather than its entire substitution for dry, coarse fodder. The most marked result in ensilage feeding is the general condition and health of the animals, just as in the case of any succulent food. The extensive use of ensilage upon any farm is mainly a question of convenience and economy dependent upon the local conditions.

Last year a farmer improvised a small silo by sinking a molasses hogshead into the ground in his barn cellar. He cut up all his corn fodder with a hay-cutter, supposing he had enough to fill about four hogsheads, but on packing it found it wouldn't fill one. He then bought of a neighbour as much more as one horse could draw, and still there was room. He then cut up the stalks from a piece of sweet corn, and with a lot of rowen managed to fill his hogshead. He made a close fitting cover, and with a jackscrew set under one of the floor timbers, pressed it down as tight as possible. In the middle of December he opened his silo, and found the corn as sweet and fragrant as when put in. From the hogshead he fed one cow half a bushel-of-ensilage morning and night for two months, and considers it the best producing food that can be had. This year he proposes to fill the hogshead with oats cut just as they are in the milk. If a silo on so simple a plan is practicable, there is certainly no reason why everybody should not have one, and satisfy himself of the value of the ensilage system.—*Nashua Telegraph.*

The latest addition to the literature regarding the *divi-divi* tree is an interesting paper by Mr. C. M. Smith, of the Public Works Department, at Masulipatam, in the Madras presidency, which has recently been published by the Local Government. Mr. Smith's remarks apply to the variety of the tree as growing in Masulipatam, and he writes as follows :—

"Height of tree, 15 feet ; boughs commencing at about 2 feet from the ground, straggling and wide-spreading, from 10 to 15 feet in length ; unarmed ; bark of a dark brown grey color, and very rugged.

"*Leaves*—bipinnate, three or four on a twig, 6 inches in length, with from six to eight pairs of *pinnæ*—pinnæ being 2 to 3 inches long ; *leaflets* paired and numerous—as many as twenty-eight pairs to a pinnæ, but varying in number in different leaves, and on the several *pinnæ* ; length ¼ inch, breath 1-16th inch.

"*Flowers*—in clusters, of a pale green-yellow; very strong, but agreeable scent. Blossom in the cold weather (twice from December to February); seed ripens in March (second crop.)

"*Pods*—curly, of a dark red-brown color and hard; an average pod contains five or six seeds, small, oblong, smooth, and of a tawny color. The length of such a pod is 2½ inches, and breadth over ⅝ inch.

"I should have mentioned that the leaves commonly have one terminal pinna, but frequently terminate in two, *i.e.*, in a pair of pinnæ.

"There are ninety trees in this garden of different sizes, most of which are producing seed, besides two or three young self-sown plants. There is no difficulty in propagating the tree; it comes up readily self-sown.

"The trees in this garden are, I am informed, about 38 years of age, having been planted by a Mr. Dick, port officer.

"The soil is almost pure sand; the roots of the trees probably reach good water, which is found not far from the surface.

"The poor nature of the soil probably accounts for the small size of the tree. I say 'probably,' because the small size is, I think, mainly due to the trees being planted too close together, in many instances there being little more that 6 feet of space between the trunks. The girth of the best-grown trees at a height of 1 foot from the ground, I find to be about 2 feet 6 inches. The trees, however, are mean in appearance, though luxuriantly covered with foliage at the right seasons of the year. They never entirely lose their foliage.

"With regard to the produce of trees, I note as follows—The total quantity of seed in pod produced in the one crop which I have lately had collected amounts to 43 sacks of 71lbs. each, or 3,010lbs., or 1·33 tons. I find that ⅜ oz. seed is obtained from 1lb. of full average-sized pods, *i.e.*, the seed bears a proportion in weight to the pod of 1-18th nearly. In one average-sized, well-developed pod, I find seven seeds; in another six. Eight hundred seeds nearly go to the ounce, *i.e.*, 12,800 to the lb. of 16 ounces. A 70lb. sack of pod occupies in bulk a space 28 inches and 18 inches diameter—nearly 4 cubic feet, and thirty-two sacks = 128 cubic feet = 1 ton.

"In regard to the value, I have never systematically endeavoured to sell the seeds and pods. There is no great demand for them here I believe. I believe they are not exported. They are, I know, used to a limited extent by the local chucklers or leather-workers in tanning and coloring leather."

Mr. J. G. Horsfall, the Collector of Kistna, in submitting Mr. Smith's paper to the Board of Revenue, has recorded the following observations on it:—

"Mr. Boileau, my forest assistant, has been directed to commence planting up one of the forest *topes* with the *divi-divi*. The tree grows fairly well in this district, both close to the sea, on sandy soil, and inland. Our avenues of trees on the Hyderadad roads seem to have flourished better than those in Mr. Smith's compound in Masulipatam. I expect that it will be largely grown as soon as its value becomes generally known, and I am informed that plantations of it are being started by some enterprising natives in the Bapatlo taluk, who had taken up land for casuarina plantations, after witnessing the result of the casuarina plantations started under the jungle conservancy.

"I see no reason why in a few years this district should not be able to supply any quantity of the pods. The tree, however, is a slow-growing one, and I regret I cannot state from personal observations at what age it first begins to yield."

We have received a copy of the "Descriptive Catalogue of Indian Produce contributed to the Amsterdam Exhibition," by Baboo Trailokya Nath Mookerjee, the officer in the Department of Revenue and Agriculture who was intrusted with the organisation of the Indian collections for the Amsterdam Exhibition. This list has been arranged alphabetically according to the modern scientific names, and has, in addition, a complete index to all its English and vernacular names. Apart, therefore, from the primary purpose for which this book has been written, it is to the credit of the author that he has so thoroughly done his work as to give us an easy book of reference on the subject of Indian produce. He has produced a neat volume of 190 pages, sure to become a standard of reference in future. As a catalogue it seems to have one defect, however, and one which it was most probably impossible to obviate, namely, there is no mention of the numbers attached to the specimens. This difficulty it is doubtless intended should be overcome by the visitors getting possession of a copy of the Official Catalogue of the Exhibition to be used along with the descriptive catalogue.

We think the manner in which each product has been treated exceedingly good, and the style and get-up of the work excellent. After the scientific name is given a small paragraph containing the leading vernacular names. Then follows a brief account of what might be called the properties and uses of the product. On the margin are stated the uses to which each product is put. For example, if the visitor wishes to learn something of the medicinal virtues of a plant, he has only to run his eye down the marginal notes to the word "Medicine," opposite which will be found the information desired. We note in the preface that the author acknowledges "his obligation to Dr. George Watt who kindly consented to correct the final proof-sheets, and thereby many inaccuracies in botanical terminology have been obviated." This is a guarantee that the scientific names are those in use at the present day. Until the reports of the Amsterdam Exhibition appear, it would be premature to comment upon the manner in which Baboo Trailokya Nath Mookerjee has discharged the duties intrusted to him as "Officer in charge of Indian Exhibits," but judging from the completeness of his "Produce—Descriptive Catalogue," we should expect to hear favourable reports on the Indian display at Amsterdam. We may mention that Baboo T. N. Mookerjee is at present the officer in charge of the Exhibition branch of the Revenue and Agricultural Department in connection with the approaching Calcutta Exhibition.

The following passage is from the United States Consul General Mattson's Report:—

The Indian agriculturalist—ryot—can in no sense be compared to the American farmer, but rather to the late serf of Russia. He is a tenant on hard conditions, and is, by custom and bigotry, almost a fixture on the particular spot of land where he was born; his farming is done on a very small scale and according to old methods, to which he clings with religious veneration; his wants are very few, and he endures poverty and even hunger with patience; he cultivates his patch of five to fifteen acres on shares for the landed proprietor—zemindar—who holds under rental to the Government, and the better half of his gross income generally goes to the zemindar, the priest (Brahmin), and the usurer, in the form of rent, presents offerings, and interest, and if he cannet ten cents a day by his hard and hopeless labor, that will suffice for the most pressing wants of his household. His home is a mud or bamboo hut; his property a pair of small bullocks, a few cows, calves and goats, a wooden cart, and a few brass and earthen pots—in all worth about $50: and his implements and tools are of the rudest kind, such as his ancestors used a thousand years ago, and yet he is making some progress under British rule, and finds his wants increasing; at the same time better outlets for his produce and more recompense for his produce and more recompense for his labor, and, on the whole is so independent on 10 cents a day that he will eat or store his wheat rather than sell below a certain price. Of course, he does not employ machinery in farming, but ploughs his land with a crooked piece of iron-pointed wood, harrows it with an implement resembling a common ladder laid flat on the ground, and dragged by the little bullocks crossways over the field he sows by hand, reaps with a rude sickle, carries the sheaves home on his back or in the bullock-cart, threshes them with a wooden club, or lets the cattle tramp out the grain, and cleans it by hand winnowing.

A flock of sheep running in the orchard is said to be the best practical protection against the ravages of the codling moth. They pick up and eat every wormy apple that drops, before the grub has time to get out of it, and so prevent their propagation. In an orchard thus pastured by sheep through the

summer, Mr. A. R. Whitway, an experienced American nurseryman, found the fruit on gathering almost uniformly sound, while in another part of the same, and separated from it only by a hedge, and of the same varieties of fruit, but not pastured by sheep, the fruit was as uniformly wormy. But every one cannot make a sheep pasture of his orchard or fruit garden. Next to this, he recommends what has already been widely published, the hanging in the trees of wide-mouthed bottles, like quinine bottles, partly filled with sweetened water, with the addition of a little vinegar. These will attract and trap the moth in large numbers. The ant, he also states, is a valuable auxiliary that can be utilised in fighting this pest. It is a carnivorous or flesh-eating insect, and will clear trees of insect foes in the vicinity of its nests. He suggests the planting of ant-hills in the orchard, by taking a spade full from an old hill and planting it in a hole in the ground. His objection to the use of torches to attract and destroy the moth is that you are liable to destroy friends and foes alike.

Professor A. J. Cook, of the Michigan State Agricultural College, has made extensive trials with arsenical compounds as a means of destroying the codling moth. It has been a matter of general experience that when Paris green or London purple has been used on potato vines it is soon washed off, and the mixture has to be frequently applied. Professor Cook fails to find any difference between the two above-mentioned insecticides. A half-ounce of either to a gallon of water is quick death to insects when spread over infested foliage. He also found that a weaker mixture, one pound of the arsenate to 100 gallons of water, was effective.

Experiments were tried to find out how long the poison remained upon the foliage exposed to ordinary conditions of rain, wind, &c. A brisk shower was found to render the poison useless. This has been the experience of many. We have found, says a contemporary, that the only profitable time is to apply the arsenic after a shower, or while the vines are wet with the dew, and if a hard rain soon follows the work needs to be done over again. Professor Cook found that insects suffered no harm by eating foliage after twenty days' exposure, and in most cases fifteen days were enough to remove the poison sufficiently to render it inoperative. When the plants were kept from the winds the time of action was much extended.

The test of the microscope was applied in all cases, and it was found that the poison had been removed from all smooth parts, and only small portions remained in holes and out-of-the-way corners. The poison is removed by chemical means, wind, rain, brushing of leaves against each other, &c., and not by being absorbed into the substance of the plant. This last is proved by careful chemical analyses that have been made to detect any traces of the arsenical compounds.

Professor Cook not only concludes that much more of the poison is used than is necessary. We may add that the importance of frequent applications is fully sustained by all these experiments.

Pyrethrum powder is safe, and should be used instead of the deadly arsenical compounds on all garden vegetables, the foliage of which is eaten. Cabages, lettuce, strawberries, &c., belong to this class.

The insects that infect the fruit and foliage of trees may be safely destroyed by a dilute mixture of the Paris green or London purple. With these the fruit is usually picked a long time after the poison is used. It is seen that we have a remedy for the codling moth that all may use. Any force pump can be employed for spraying the trees. The nozzle fitted with a fine nose may be arranged upon the end of a long pole, and in this way the poison mixture is brought to all parts of the tree.

There is a right and wrong way to make a hole in the ground, and set out a plan,tsays a contemporary. Some persons remove ten times the necessary amount of earth, and do not give the plant a good setting as one does it in one-tenth of the time. Small plants of vegetable and flower garden are best transplanted with a sharpened stick or dibble. This simple implement should have a bend for a handle like that of an umbrella or cane, only less. It should be thrust perpendicularly into the well-prepared soil, there rotated and removed. The left hand at the same time picks up the plant, and after picking it in the hole, the dibble is pushed into the soil to one side, and in a slanting position, starting about three inches from the opening and running to meet with the bottom of the first hole. By pushing against the dibble and bringing it towards the plant, the earth is pressed up properly, and the work is quickly and well done.

The Nallamalai forests contain large valleys with good soil and covered with forest of teak. Yegi (*Petrocarpus Marsupium*), Nallamaddi (*Terminalia tomentosa*), and Blackwood (*Dalbergia latifalia*), while fine trees of other kinds, likely to prove valuable in the future, yield a cover which keeps the soil moist, and ensures a good reproduction. The hill slopes are naturally drier, but, still, will supply a large amount of bamboo as well as quantities of Chiriman (*Anogeissus latifolia*) and other good wood used in the country. The proposed railway line from Tadpatri or Adoni to Guntur will pass through the forests by either of the two great main roads, the Nandikanama and Mantralakanama (Dornal Pass), and will be enabled to draw large supplies of fuel from them, which can easily be arranged for under a regular working scheme to the benefit of the forests. At present a considerable amount of wood is taken out, and finds its way to the less well-supplied districts of Bellary and Anantapur, and even further, and the Kurnool-Cuddapah Canal can probably be made use of to extend the area to which produce can be taken.

"How many young men," says the *Farmer's Review*, "ever think of studying practical farming with some successful farmer? An old farmer—he was old in experience rather than years—called on us the other day, and talked an hour of his experience in draining lands, raising sheep and horned cattle; the breeds he had kept, and the best for such and such purposes; of his experiments with the several varieties of apples; of how he " learned the poultry business," &c., &c. " Now, is it going far out of the way to say that not one young man in a hundred, who to-day proposes to follow farming the rest of his life, seriously thinks of going out to live a year or two with one of these practical farmers, so as to learn the business? When a young man proposes to follow the law or medicine as a profession, he goes to some good lawyer or physician, and spends a year or two in ' reading ' law or medicine. Now, why should not a wide-awake, energetic, ambitious young man study farming with some practical farmer who tried all these experiments? We think at the end of one or two years the young man would know absolutely more of practical farming than he would learn by himself in ten years. In other words, he would start out as a young farmer nearly where the older man of whom he learned stands to-day. If the young man makes a success he has got these things to learn, and learn by experience, too, and why not study with some good, practical, thorough farmer—go and work on his farm as a hired man. We found a graduate of the Massachusetts Agricultural College a few years ago as the hired man of a practical, successful, and thorough farmer, studying farming. We met a young agent of the French Government studying farming in America in the same way. He had worked with practical farmers in the great cheese regions of New York, with the cattle-men on the plains, and was on his way to the frontier for further study."

Will the day ever come in India when the sons of zemindars, and others interested in Indian agriculture, will take to a similar practical fashion of acquainting themselves with the agriculture of their own land?

The following note on deep *versus* shallow ploughing is from the *Farmer's Review*:—

Agriculture has not as yet become a fixed science. While certain principles have received general recognition, in regard to other matters, theory and practice are constantly undergoing changes, as superior practical results are wrought out by a departure from established methods. Not so very long ago, the theory and practice for using manure was to plough it under as deeply as possible. Now the surface application is most in practice. Deep ploughing has been associated with the idea of

good husbandry, and shallow with its opposite, and it would have required a good deal of moral courage for a farmer who took pride in his work to acknowledge that he ever ploughed land for a crop only three or four inches deep. He would have been a loser in reputation among his neighbors by such an admission ; it seems now to be pretty well established by practical results that, under some conditions, the farmer who ploughs deep does it at the expense of the crop, for that season at least. Theories based upon established facts, or which can be proved true by practical results only, have value. Before giving our theory on the subject of deep or shallow ploughing, we give one or two practical results recently brought to our notice. The first is a statement by a correspondent of the *Journal of Agriculture*, who says : "I ploughed eight acres last spring about eight inches deep, harrowed it fine, and it was as nice a bed for planting as I ever saw. Well, I planted it early, that is, early enough, and then I worked it with my riding plough pretty deep, and it was pretty clear of weeds. There was a fellow on the other side of the fence, with a very light plough and light horses which were not able to plough more than three inches deep. When he worked it he did it mostly with a narrow-bladed scraper that would scarce go into the ground at all. But what surprised me the most of all was, that when we husked our corn, that chap had ten bushels more to the acre than I had."

About the same time that the above fell under our notice, the Hon. Samuel Dysart, of Franklin Grove, Ill., a member of the State Board of Agriculture, gave the results of an experiment of his own in deep and shallow ploughing. Last spring, in preparing a field for corn, he ploughed the alternate lands deep and shallow—the one as deep as a heavy team would turn the soil, eight or nine inches—the other, not to exceed three or four inches. In planting, he planted across the lands, so that there should be no possible difference in the seed, manner of planting, or cultivation. The corn on the shallow ploughing came up nearly a week ahead of that on the deep ploughed land ; it continued growing till near maturity, when the latter took a start, and shot up two feet above that on the shallow ploughing, and was still growing when the frosts came, and gave no sound corn, while that on the shallow ploughing all matured. Now for our theory. The deep ploughing brought to the surface a soil not probably lacking in the elements of fertility, but which having been buried under six to eight inches of soil, was not in condition to furnish plant nutriment until it had undergone a chemical change, through the action of the air, sunshine, rain and frost ; while the surface soil, which had been subjected to these influences, was turned under so deep that it was not available as plant nutriment, certainly till near the close of the growing season. The shallow ploughing gave a seed bed of the surface soil, which furnished plant nutriment from the start, and thus ensured an early growth and maturity of crop. The conclusion to be reached is not that ploughing should be uniformly shallow, but that deep ploughing should be done in the fall. When so done, the soil exposed to the action of the elements during the winter will be properly prepared for a seed bed in spring, when but a shallow stirring need be given it. But if ploughing is delayed till spring, deep ploughing at that time will be at the expense of that season's crop. While it is unquestionably true that all soils should be worked deep, it is a question worthy of careful experiment whether this is necessary every year, or whether, say on alternate years, a shallow stirring of the surface to the depth of three or four inches by some implement which will do the work much more rapidly and cheaply than the plough, will not bring equally good results with a saving of time and labor. Such experiments, to be of value, should be on soils of different quality and texture and on the different crops grown by the farmer. We suggest this subject to those in charge of our agricultural colleges and experimental stations.

Darlington is one of the few towns in the north o England owning a sewage farm, and the statement of its accounts just issued for the financial year ending in March is (says the *Newcastle Chronicle*) interesting, because there can be no doubt that many towns on river sides will some day be forced, as was the town on the Skerne, to divert their sewage from the stream and utilize it on the land. This course was forced upon Darlington some years ago. It bought land and formed a farm to utilize the sewage at a cost to the present of £100,645. In the financial year just closed it spent £7,205 on the farm, including £4,981 for interest on and repayment of loans. The receipts were £7,805, inclusive of £5,000 from the borough rate, so that the farm paid its way as a farm in spite of the bad harvests, but the town has to pay the interest on the money borrowed, and this is the cost to it of keeping the sewage out of the river. There are 50 cows on the farm, and 100 cattle, sheep, and pigs ; so that Darlington Corporation is a farmer on a tolerably large scale. But Darlington has in its own hands the gas and water works that supply the borough. These works have cost the borough in round numbers £200,000. Last year the receipts were—Gas works, £19,853 ; and water works, £9,905. Both left very handsome sums to the profit of the works. After paying the interest on the loans there was a credit balance from the working of the two of £8,157, so that they pay much more than the interest on the loans on the sewage farm (repayment of principal being for the moment left out of the question). In other words, taking repayment of debt into account, if the people of Darlington would use a little more of the cheap gas their works make, and the water they get for the asking from the Tees, they would from the profits gradually redeem the works from the loans upon them, pay the interest on the sewage farm, and ultimately free the latter from its mortgage.

Bee-keeping in India.—On this subject, a correspondent of a Calcutta paper, after relating several facts regarding the domestication of bees in several villages of the Hooghly and Burdwan districts, says :—

"Perhaps you may not be unaware of the fact that the respectable Dutta family of Nimtollah owns an estate in east Bengal, which is chiefly valuable for the cultivation of bee-hives amidst the water-lily plants. The honey collected from these hives is generally known as 'bly-honey,' and is sold at Calcutta and other places at a high price. From these facts, I am of opinion that if the scheme is favourably supported by the Government, and the people are encouraged to extend bee-keeping, it will certainly take a footing among the paying industries of the country."

A correspondent writes to us that the cultivators, who form about 75 per cent of the population of the N.-W. P., never dream of using chopped timber for cooking purposes unless at weddings when they collect it for months if not years previously, and then use a certain percentage of cowdung with the wood, or at funerals, when the whole village often combines to furnish the fuel. Cowdung is also used here—a little of it. The average cultivator holds about 10 acres, 5 of which bear fuel crops, for they chiefly use arhar, cotton, and castor stalks where flame is required ; cowpats are used freely for everything, and by mixing straw with the cakes, they can be made to burn with a flame without the unpleasant smell of burning straw. At a low computation five acres give 25 maunds of fuel annually, and as the average cultivator also owns a pair of oxen and a cow buffalo and calf, and he will also have, if his wife is industrious, about 75 maunds of cowpats—a great deal of cow-dung is lost when the cattle are in the fields, and in the dry weather this is the potters' perquisite). In all, 90 maunds, or 10 seers of fuel daily, if he requires so much, and he does not by any means, often selling his fuel and using his arhar and cotton stalks freely for wicker linings for his wells.

Those that are not cultivators, send their children to pick sticks in groves, and collect *madar* stalks, useless thorn he dges, &c.

The *Farmer's Review* has the following note on changing the bearing year of apple trees :—

Most varieties of apples bear only on alternate years, giving an abundance of fruit one year and little or none the next. But this bearing year in a tree can be changed by removing the blossoms on the bearing year and allowing it to bear no fruit, when it will make a set of fruit buds and bear the next year. In a young orchard this habit can be noticed and

changed by the above method on a portion of the trees, at the expense of but little labor, so as to have a part bearing fruit every year. With a step-ladder and pair of shears the work can be rapidly performed. It is not too late now, even if the blossoms are gone and the fruit set. Its removal is as easily accomplished, and with the same result.

The report by Prof. Henry of "Experiments in Sorghum" at the experimental farm of the university of Wisconsin, of which a brief summary was given in a recent issue, contains also voluminous extracts from correspondence from sorghum growers and manufacturers throughout the state upon methods of cultivation, manufacture and cost value of seed, skimmings, &c., a few of which we subjoin.

O. S. Powell, of River Falls, on the subject of skimmings, says he runs them into tanks to be made into vinegar. He says: "We make the best of vinegar by merely giving it time to work, and then pass it from one tank to another for the purpose of straining and filtering. Six thousand gallons were made last fall in this way that by the first of June will be better vinegar than is obtained from any other source, not excepting old cider or maple sap." This vinegar is made at scarcely any appreciable cost, and the idea is well worth being adopted by other syrup makers.

Ambrose Warner, Whitewater, says: "I fit my land as though I were going to plant it to onions, then I always get a good stand. Go over with a drag last; that fills up all the horse track and leaves it ready for the planter. * * * * I plant three feet eight inches between the rows, and from two and-a-half to three feet in the rows; plant about one inch deep; drag before planting. When the cane is up bring the shields (on the cultivator) within two inches of each other, and by driving slow can do a nice job as I have no lumps to bother. When the cane is two or three inches high, clean out the weeds in the hill, then cultivate same as corn. When ready to cut I take a saw-buck, made longer than for sawing wood, set it between the second and third row, cut four rows and throw on the horse. When I have enough for a bundle, bind it and cut off the tops with one blow of the corn knife. Then lay the bundle over next the standing cane, and so as to have the bundles of next four rows cut laid on them. Bind and set up my seed heads, then rake up the leaves stripped off with a horse rake."

Edwin Blood, Stockbridge, on the subject of manufacture, says: "Heat the juice in the desecator to about 150 degrees; add milk of lime until the juice shows by blue litmus paper slightly acid, or until the paper shows a light pink color. Heat rapidly until the scum turns dark colored. Let it stand a few minutes, then draw into evaporator; then skim and evaporate as rapidly as possible to 228° or 230°. * * * If above instructions are carried out, one cannot fail to make a light colored, clear syrup perfectly free from that detested sorghum taste, and which will sell at any time in any market."

As for the cost of making syrup much depends upon the state of the weather, ripeness of the cane, machinery and help employed. In the fall of 1881, it cost me 11 cents per gallon for manufacturing, and the past fall (1882) only 7 1·6 cents per gallon.

Evan Erickson, of Stevenson, P. O., La Crosse county, submits a detailed statement of total cost of raising and manufacturing ten acres of cane, which, being condensed to save space, foots up as follows:—

Preparing the ground...	$ 20·50
Planting and cultivating	36·00
Harvesting and hauling	55·37
Labor and fuel in manufacturing... ...	132·00
Board of men and teams	81·55
Barrels for syrup	31·00
Hauling syrup to market	31·00
Total cost ...	$387·42
Cr. by 1,570 gallons syrup, sold at 40c. ...	$628·00
Deduct expenses	387·42
Net profit ...	$240·58
Net profit per acre ...	$ 24·05

Hollister S. Philips, of Mindoro, La Crosse county, writing of the value of seed, says: "The yield of seed, as near as I could estimate, was twenty-two bushels per acre. * * * One hundred and eight pounds of seed yielded sixty-six pounds of flour. We used cane seed flour in our family from the time of threshing in November till the next August. For griddle cakes it is nearly equal to buckwheat (some of our neighbors claim it is superior), and mixed equal parts with buckwheat we could see no difference. For soft ginger cake it is excellent. * * * As a feed for cattle, horses, and hogs I know it has no equal. There is no grain that will make horse gain in flesh faster. For milch cows a person cannot estimate its value till he has tried it. It is especially valuable for young stock and calves and for hogs. I know that it is worth more per bushel than corn, and when I say more I mean that there is a great difference. In the spring of 1881 we killed a hog that had been fatted wholly on cane seed. The meat was as hard and sweet as ever tasted. This hog was fed on nothing but cane seed and water, yet it took on flesh faster than any hog I ever fed."

The following is the substance of Dr. Aitken's report read before a recent meeting of the Highland and Agricultural Society:—

"I have to report regarding the progress of the work of the chemical department that the experiments at the society's station have been successfully laid down. The crop this year is barley, succeeding turnips, and though there is a healthy braird to be seen, yet the long drought has to a considerable extent prevented the manures from coming into operation. Crops to which only light manures are applied suffer most from drought, and it will be some weeks before the experiments at the stations will be worthy of a visit. In addition to the general scheme which has been followed from the beginning, the plots on the stations have in most cases been divided into two parts, to show the different effects of nitrate of soda when applied with the seed and when applied some weeks later. A few odd plots have been utilized to test the efficacy of some forms of manure which are now becoming important, and experiment is in progress at both stations to test the effect of potash on the potato crop. The analysis of the turnip crop of last year is progressing, but owing to the large scale upon which it is being carried out, and the greatly increased number of the plots under experiment, it will be months before it is completed. A large number of schedules have been sent out to farmers in various parts of the country, describing a simple method of testing the fertility of the soil, and so enabling farmers to discover what manurial ingredients their soils most require. It is a small experiment applied to the turnip crop, costing almost no money and very little trouble, and is capable of yielding information which will enable those who try it to effect some economy in the manuring of their land. The silo at Portmore, whose construction was sanctioned by by the society at its last meeting, has now been built. It is made of concrete, and has a capacity of about 170 cubic yards, and it is capable of accommodating about 100 tons of ensilage. The crop to be put into it are of several kinds, *viz.*, about 8 tons clover grass; about 20 tons natural grass, cut from plantations and roadsides; about 12 tons of green oats, partly after lea and partly sown out; about 30 tons of corn and pease, and about 30 tons of tares. These will all be cut and siloed at their greenest, and kept during the winter under a pressure of about 200 lbs. per square foot of surface. In addition to this silo, Mr. Mackenzie is constructing another of slightly larger dimensions to store the produce of 12 acres of natural grass and 8 acres of clover grass, and also a silo on the hill farm consisting of a pit dug in the dry earth, and intended to hold about 10 tons of bog grass. The purpose of these experiments is not only to test the suitability of silos for the preservation of fodder crops grown in this part of the country, but also to furnish information regarding the value of fodder so preserved compared with that of the crops at the time of cutting, and with the same when made into hay. Intimation will be given of the time when the silos are to be filled, so that any members of the society who are interested in the experiment may have an opportunity of witnessing the operation."

THE following method of preserving eggs fresh is in use in America :—"I have been in the egg trade for several years, and this is my method of preserving eggs. Take 12 pounds unslacked lime, 2 pounds salt, 2 ounces cream tartar. Slack the lime in a tub, and then add the other ingredients. Make the solution strong enough to bear up an egg. For family use fill a ten or twelve gallon jar with eggs, be sure there are no cracked ones, and then fill in with the solution and they will keep good and fresh a year."

PARTIES claiming to be posted in sericulture assert that this State can annually produce $30,000,000 worth of raw silk. This is about twice the amount of gold yield, and it would seem that, as mining gives out, sericulture might be profitably entered upon.—*Sacramento Bee.*

THE quantity of Tea per acre in Darjeeling is probably fairly represented in the latest report of the Darjeeling Tea Company (Limited). The figures for five years ranged from 318lb. per acre to 369, so that the average is about 350lb. Now, if estates between 3,000 and 5,000 feet altitude give 350lb. per acre in 27° north, there will be nothing wonderful in an average of 500lbs. per acre at similar altitudes in Ceylon, but 20° nearer to the equator, and with the always more genial climate of an island.

A HEALTHY condition of the Canadian finances is reported. The revenue for the eleven months for the current fiscal year ending with May amounted to $32,330,103, and the expenditure to $24,109,926, leaving a surplus of over $8,000,000, or 1,600,000*l*,—that is to say, a sum of 1*l*. for every three inhabitants.

A LARGELY attended conference of representatives of Municipal bodies and Mining Boards was held at Melbourne on the 5th June 1883, to devise measures for the conservation of State forests. Several members of Parliament also attended. It was admitted on all hands that the management of the forests by the Government has been shameful, and that timber has been wasted in a wholesale manner without regard to future requirements. The conference considered that it was incumbent on local bodies and others directly interested to obtain control of the forests within their respective boundaries, and decided that a deputation should wait on the Minister of Lands to-morrow to urge that the forests should be vested in Boards consisting of representatives of the Mining Boards and municipalities within the respective districts, who should be empowered to impose such restrictions as are necessary on the felling of timber, carry on the work of planting and thinning where necessary, and generally undertake the management of such reserves. It was also suggested that the forest be let by the Government for grazing purposes, and a portion of the proceeds handed to the proposed Boards.

DR. SALMON, who has investigated the subject of chicken cholera for the Chicago Department of Agriculture, its cause and prevention, gives the following on the subject of disinfecting poultry-houses in which the disease has appeared :

"For this disease a very cheap and most effective disinfectant is a solution made by adding three pounds of sulphuric acid to forty gallons of water (or one-fourth pound sulphuric acid to three and a-half gallons of water), and mixing evenly by agitating or stirring. This may be applied to small surfaces with a small watering pot, or to larger grounds with a barrel mounted on wheels and arranged like a street sprinkler. In disinfecting poultry-houses the manure must be first thoroughly scraped up and removed beyond the reach of the fowls; a slight sprinkling is not sufficient, but the floors, roosts, and grounds must be thoroughly saturated with the solution so that no particle of dust, however small, escapes being wet. It is impossible to thoroughly disinfect if the manure is not removed from the roosting-places. Sulphuric acid is very cheap, costing at retail not more than twenty-five cents a pound, and at wholesale but five or six cents; the barrel of disinfecting solution can, therefore, be made for less than a dollar and should be thoroughly applied. It must be remembered, too that sulphuric acid is a dangerous drug to handle, as when undiluted it destroys clothing and cauterizes the flesh wherever it touches."

THE plague of rabbits from which our Australian colonies are suffering has led New South Wales to pass a new and more stringent Rabbit Act, the provisions of which do not err on the side of leniency. Henceforth, any person who shall have in his possession any live rabbit, or even shall introduce into the colony from any other colony or place any rabbit scalps, is liable to forfeit and pay for each offence a sum not exceeding £100, or in default of payment, be liable to a term of imprisonment not exceeding six months. Hitherto the rabbit has not been a terror to our American colonies, but according to the last mail from Canada, his increase in the Dominion is occasioning some alarm. The Natural History Society of Toronto has brought the matter before the Commissioner of Agriculture, and demanded the extermination of the rabbits, which a few years ago were imported to Toronto from England. To do this effectively a set of questions has been sent out by the Government, asking for information on the subject, at the same time giving a description of the rabbit of the country and the English rabbit, which alone is to be treated as vermin, and exterminated accordingly.

FROM a paper by P. H. Jacobs in the *American Agriculturist* we quote the following hints :—

An acre can produce $000 in poultry, and the capital required returned by the poultry in a short time with profit. With a systematic method of cleaning and feeding, more profit, with less labor, can be derived from poultry on one acre of land than from the best regulated dairy under the soiling method. An acre, devoted exclusively to poultry, will return a greater profit, with less cost in labor, than ten acres of wheat or any cereal crop. The poorest and lightest of sandy soils are more suitable for poultry than the best pastures, as they are freer from disease. That yards free from grass, and clean to every corner, are better than grass runs, has been demonstrated; but shade of some kind should be supplied. No poultry-house can be kept absolutely clean without a board floor. In setting hens, the nests should be in warm, dry locations in cold weather, and in cool, moist places in summer. In selecting for breeding purposes, plumage and points of marking should give way to robust constitution, vigor, and activity. Feeding steeped clover hay and linseed meal assist in the formation of the white of eggs, by supplying nitrogenous matter. The houses should be freely ventilated in summer, and warm in winter. All soft food should be freshly mixed. Yellow-legged fowls sell better than those with dark legs. All non-sitters lay pure white eggs. No male should run with over twelve hens—a less number would be better. Eggs from two-year-old hens are preferable for setting purposes. Exercise should be furnished by throwing a small quantity of corn into a bundle of loose straw or hay, for fowls to scratch. Keep a good dust-bath always. Spade up the ground as often as possible. When a rain is threatened, see to the young chicks. Early-hatched pullets are the winter layers. Keep no fowls for beauty, if profit is the object. Use pure-bred males always. Large males bred on small hens produce legginess in chicks, but small males on large hens produce closer bodies and shorter legs. Never use a male with his own offspring. It is a saving of time to let a hen sit, in preference to breaking her, as hens lay but few eggs when deprived of sitting, and go at it in a week or two. Breed your own fowls, and never bring them to your yards from other places. Hens lay as well when not in company with males as when with them, and such eggs keep fresh longer. Young chicks, when feathering, undergo severe natural drain on the system, therefore never omit a meal. Use only the freshest eggs under sitting hens. Hot white-wash, containing carbolic acid, liberally applied, will kill or keep off vermin. The rough scales on fowls' legs are easily removed by a mixture of lard and sulphur, or coal oil. Finally, be as attentive to fowls as to horses, cattle, hogs or sheep, and be in your yard from morning until night.

W. I. Chamberlain, Secretary of the Ohio State Board of Agriculture, and one of the most reliable and intelligent officials in that line in the country, publishes on the basis of official telegrams received June 7th, the following table, showing percentages of the condition of wheat at that date, compared with June 1, 1882, together with the yield in 1882 and probable yield in 1883, in the twelve principal wheat-growing states of the Union, which last year produced nearly four-fifths of the entire wheat grown in the country.

It is as follows :

States.	Per cent, June 1.	Bushels in 1882.	Probable bushels in 1883.
Ohio	52	45,454,000	23,382,000
Indiana	66	45,402,000	30,005,000
Iowa	86	25,487,000	21,919,000
Kansas	71	33,248,000	23,680,000
Minnesota	88	37,031,000	32,750,000
Illinois	32	52,603,000	16,000,000
Kentucky (about) ...	50	17,250,000	8,417,000
Michigan	67	33,315,000	22,321,000
California	88	34,547,000	30,000,000
Wisconsin	86	20,115,000	17,224,000
Tennessee	82	8,671,000	8,971,000
Nebraska (spring) ...	111	13,673,000	15,399,000
Total	...	367,036,000	250,068,000

He says: "This gives a probable shortage of nearly 117,000,000 bushels in these twelve states, and makes it probable that the crop of 1883 will be even smaller than that of 1881; at least in proportion to acreage and population; and this will leave less surplus above 'seed and bread' for export."

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly Meeting was held on Wednesday, the 20th June 1883.

W. H. Cogswell, Esq., *President, in the chair.*

The proceedings of the last meeting held on the 19th April were confirmed.

The following gentlemen were elected Ordinary Members :—

H. J. Haynes, Esq., Manager, Jatooke Garden, Meleng Estate, Assam.

R. B. Yates, Esq., Deputy Conservator and Harbour Master Calcutta.

A. Campbell, Esq., Assistant Conservator of Forests, Gorukhpore.

Dr. J. Mullane, Civil Surgeon, Dhubri.

Manager, Moonoo Tea Estate, Darjeeling.

Captain J. G. Morris, Cantonment Magistrate, Saugor, C.P.

W. L. Thomas, Esq., Merchant, Calcutta.

The names of the following gentlemen were submitted as desirous of joining the Society :—

G. E. Manisty, Esq., C.S., Magistrate, Cuttack,—proposed by the President, seconded by Mr. J. E. MacLachlan.

Edward Bigge, Esq., Merchant, Calcutta,—proposed by W. H. Cogswell, Esq., seconded by Mr. R. Blechynden.

Baboo Ishar Prosad Gorga, of Moisadal palace,—proposed by Raja Suttyanundo Ghosal, Bahadoor, seconded by Baboo Jaikissen Mookerjee.

E. W. Read, Esq., Manager, Latakoojan Garden, Assam,—proposed by Mr. R. Blechynden, seconded by Mr. J. E. MacLachlan.

Baboo Sitolchand Nahar, Azimgunge,—proposed by Baboo Jaikissen Mookerjee, seconded by Raja Suttyanundo Ghosal, Bahadoor.

Edward J. Lawder, Esq., Private Secretary to the Nawab Vikar-ul Umra, Hyderabad, Deccan,—proposed by Mr. G. L. Kemp, seconded by the President.

J. D. Maxwell, Esq., Merchant, Calcutta,—proposed by W. H. Cogswell, Esq., seconded by G. L. Kemp, Esq.

C. A. Samuells, Esq., C.S., Magistrate, Bancoora,—proposed by Baboo Pertab Narain Singh, seconded by Raja Suttyanundo Ghosal, Bahadoor.

W. Bleeck, Esq., Imperial German Consul, Calcutta,—proposed by W. H. Cogswell, Esq., seconded by E. Delius, Esq.

R. Deey Spedding, Esq., C. S., Collector, Moradabad, N.-W.P.,—proposed by Raja Suttyanundo Ghosal, Bahadoor, seconded by Baboo Jaikissen Mookerjee.

The Nawab Vikar-ul-Umra, Hyderabad, Deccan,—proposed by Dr. King, seconded by the President.

C. A. Soppitt, Esq., Assistant Superintendent of Police, Cachar,—proposed by W. Aitchison, Esq., seconded by Baboo Jaikissen Mookerjee.

R. Blechynden, Esq., Jr., Calcutta,—proposed by Mr. R. Blechynden, seconded by Mr. J. E. MacLachlan.

Re-joined—A. L. Keith Murray, Esq., Manager, Borpanee Tea Estate, Nowgong, Assam.

Chas. L. Ambler, Esq., Mongbyr.

Contributions.

A selection of seeds from Trinidad, West Indies. Presented by Dr. J. B. Menzies.

A quantity of Mahogany seed. From Baboo Prosonocoomar Banerjee.

A packet of Broussonetia papyrifera (paper mulberry). From Dr. King.

A large quantity of acclimatized maize seed. From the Maharaja of Durbhunga.

A bottle of green sorrel seed. From Mr. J. Stalkartt.

A wardian case of plants from Mr. E. Koek, of Singapore. (The Secretary was directed to send a suitable selection of plants in the return case.)

A large number of Mahogany seeds from Trinidad. No advice had yet been received regarding these seeds, but they were sown immediately on receipt, Mahogany seeds being so extremely liable to deterioration.

The annual report of administration of the Customs Department in Bengal. From J. Scobell Armstrong, Esq., C.S., Collector of Customs.

Two copies of the Implement and Machinery Review. From the Publisher, H. Westcott, 23, Budge-row, London.

The Manual of Agriculture for India, by Lieut. F. Pogson. By the author.

Department of Agriculture Report for the year 1880. Presented by the Smithsonian Institution.

Proceedings of the Boston Society of Natural History, part of Vol. XX, and 3 parts of Vol. XXI. From the Smithsonian Institution.

The *Indian Forester*, No. 5, Vol. IX. From the Editor.

Journal of the Asiatic Society of Bengal, Part 1, No. I of 1883, Vol. LII, and Proceedings for February and March. From the Society.

Systematic Census of Australian Plants, Part 1, Vasculares, by Baron Ferdinand von Mueller K.C., M.G., M.D., &c. &c. From the author.

The Tropical Agriculturist for April and May, (two copies each). From the Editor.

Memoirs of the Boston Society of Natural History, Vol. III, Nos. 4 and 5. From the Society.

Report of the Alipore Reformatory School for the year 1882. From the Superintendent.

Report of the Calcutta Court of Small Causes for the year 1882.

Proceedings of the Agri-Horticultural Society of Bijnour. From the Secretary.

Proceedings of the Agri-Horticultural Society of Madras—Annual Meeting and Ordinary Committee Meeting. From the Secretary.

The Secretary was directed to acknowledge all the above contributions, and tender the thanks of the Society to the donors.

Communications.

Letters, enquiries, and communications on various subjects were read.

From Mr. J. Horne, of the Botanical Gardens, Mauritius, to say a wardian case of selected sugar-cane including "Desiderata," would shortly be sent.

Major D. G. Pitcher, of the Agricultural Department, N.-W.P., for a maund of Carolina paddy seed. (To be supplied on arrival from America.)

Mr. E. H. Boileau, Forest Department, Masulipatam, asking for seed of the Rain-Tree (*Pithicolobium Saman*). Application complied with.

Chas. P. W. Martin, Esq., Tezpore, Assam, promising a further supply of cane seed from the Duffla Hills.

C. Casperz, Esq., Sub-Divisional Officer, Sasseram, enquiring if the Society can procure seed potatoes for experimental planting in certain Government Mehals. (A reply in the affirmative was sent to Mr. Casperz, who was asked to make an application when the season for planting potatoes approaches.)

In connection with this subject, Baboo Jaikissen Mookerjee promised a supply of potatoe seed, a very favorable report having been made on samples submitted by him at one of the Society's meetings.

A letter from J. Binning and Co., enquiring for details of working of the Mexican Aloe Fibre Machine, alluded to in the Proceedings of the 21st March last. All the trials up to date not having proved satisfactory, a report is withheld pending further trial.

Moongah Silk.

The following letters on this subject were read :—

J. W. Holderness, Esq., Simla, 25th April 1883.—I am directed to forward a copy of a letter from the Political Agent at Baghdad, and its accompaniment, together with the sample of the fibre therein alluded to, and to say that this Department would be glad to be favoured with any information available that would lead to the identificaton of the plant which yields the fibre in question.

W. Tweedie, Esq., Bagdad, 30th January 1883.—I enclose copy, with English translation, of a letter in Turkish, just addressed to me by his Excellency Muhammad Hidayat, the Mushir Pasha, or Commander-in-Chief of this Wilayat ; asking for a supply of a seed which, as far as can be made out, is that of the fibre from which, in India, the fabric known as Mugra silk is made.

From his Excellency Muhammad Hidayat Pasha, to H.B. M's Officiating Consul-General, Baghdad, dated Baghad, 29th January 1883.

* * * * *

"*Translation.*—It is understood that a fibre called in this country Shaari, believed to be a species of flax which is much used in embroidering, is produced abundantly in India.

"My idea is that the rich soil of this Wilayat would surely produce the article in question if the seed were introduced, which

would be the rendering of a service only to be expected from the interest you show in matters of public benefit; and if you will permit me in taking this opportunity of expressing my friendship and regard, to ask you to apply to the Government of India for a supply of the seed in question, I shall esteem it a favor."

The following report was furnished by the President:—

It is a difficult thing at all time to form any thing like a reliable opinion on such a very small sample of fibre as the one now referred to, and to be able to state with any degree of accuracy what it really is, or to identify the plant from which the fibre has been produced.

My first impression was that it might be the Sansevierа Zeylanica, the moorva fibre Sans murva or Beng. Moorga and Moorgavee, described by Sir Wm. Jones in his *Asiatic Researches*, the leaves of which plant I send herewith. The same fibre is referred to by Dr. Roxburgh, Dr. Forbes Royle, and others in their several works on Indian Fibrous Plants, as used for ropes, lines, bow strings and producing a soft fine fibre, resembling silk, and capable of being spun and manufactured into cloth.

On comparing the sample, however, with the Moorgah or Moonga Saccharum, Munga Silk Fibre, some specimens of which from Assam are in the Society's Museum, presented 42 years ago, and with a sample kindly placed at the Society's disposal by Dr. McCann, Officiating Secretary of the Economic Museum, they correspond so exactly with the above-named Persian sample that I think they are identical. Dr. McCann also drew reference to Balfour's Encyclopædia, in which work this silk fibre is spoken of as having been mixed with cotton and manufactured into a fabric at Dacca, which was largely exported to Jeddah and Bussorah, and it may be to this that his Excellency Muhamed Hidayat Pasha refers in his letter to the Political Agent at Baghdad.

W. H. Cogswell.

The Deputy Secretary intimated that an acknowledgment of the above report had been received from Mr. Holderness, Offg. Under-Secretary to the Government of India, who had mentioned that specimens of the fibre are being procured from the places mentioned in Mr. Cogswell's note.

A New Tea Insect.

Messrs. Begg, Dunlop and Co. write:—

"In continuation of previous correspondence, we have now the pleasure to hand you per bearer a tin, containing a number of the insects received from the Lung Ling estate, the manager of which wrote us as follows:—

"'I am packing up for despatch to you a large quantity of the new tea insects in two of their different states. I cannot obtain the moth. I hardly think it is time for it yet.'"

The insects were forwarded to Dr. Anderson, of the Indian Museum, who had kindly consented to observe their habits, and who had procured a supply of food suitable for them from Dr. King; any further communication received on the subject will be published in due course.

The attention of the members present was drawn to some very large specimens of tea leaf from the Dooars forwarded by Mr. F. F. Wyman, editor of the *Tea Gazette*. In reply to an enquiry as to whether the bushes from which the specimen had been taken were treated in any special manner, Mr. Wyman forwarded the subjoined communication from his correspondent:—

I send you specimens of tea leaves of this season's growth from the Western Dooars. Several you will see are exceptionally large for the first three leaved and the bud, and will give great weight of tea.

"*Bagracote*, 18*th May* 1883.—Your favour of the 8th instant to hand, I am glad to hear you have received the tea leaves and shoots safely. The leaves and shoots represent the average of the major portion of this garden.

"A portion of the tea is eight, rising nine years, and a portion seven, rising eight years. We have several other blocks just as good, and few blocks of pure indigenous and extra good hybrid *much better*. As the latter are, however, young bushes, and at the further end of the garden I did not pluck any samples from them. I could, I think, send you leaves nine and ten inches long. As the bushes, though young, are very fine for their age, no part of this garden has ever been manured, nor have any of the blocks received any special treatment. The growth in the Dooars is really most astonishing. I have never seen such *rapid* growth in Assam."

Mr. Wyman also forwarded some leaves for identification.

"I send you also some leaves of a plant very much like those of the tea plant, for which they are often mistaken."

Dr. King kindly identified the leaves as those of the Eurya he remarks, has frequently been mistaken for tea. The Deputy Secretary mentioned that he had some years ago seen some "tea" made from the leaf in question which had all the appearance of the genuine article.

Rhea, or China Grass Seed.

A letter from Mr. Bleeck, Imperial German Consul, was read—

"I have been requested to procure some pounds of good sound seed of the Ramieh (nettle) plant.

"Several Agricultural Societies in Germany have vainly tried to procure good healthy plants from seed obtained from France, and are now desirous to make an experiment with the real Indian seed.

"I therefore venture to ask whether you will be kind enough to procure the said seed for me, or if this be impossible, would you please inform me where it can be got?"

The Secretary mentioned that the seed was difficult to procure, as it is seldom preserved owing to the fact of the plant being much more easily and readily propagated from cuttings and divisions of roots, and that he was informed by the Superintendent of the Government Botanical Gardens, Saharunpore, that it did not seed there at all, the plant being of one sex, though he had once raised Rhea from seed procured from Java. Efforts are being made to obtain the seed to meet this and other similar applications.

Wheat and Cotton.

Samples of these were sent by the Superintendent, Agri-Horticultural Society's Garden, Lahore, on which the following report was given:—

"*Cotton*.—This sample of Kuppas, that is, with the seed left in uncleaned, is most beautiful, the staple is soft, silky, long, strong, and of a clean, white color. It would sell most readily in the Home markets if the seed was separated from the fibre, and would realise high prices, as compared with the American cottons. It would have to be sent to Europe, for the quality is far too good for the local mills in India, whose spinnings are almost entirely on low counts of yarn. It would be interesting to see a sample of this cotton after the seed had been separated from it.

"*Wheat*.—The samples marked C 1, 2, and 3 are not sufficiently marked in character to separate, so must be taken as a whole. They would rank with Allyghur wheat worth about Rs. 2-14 a maund. The grain is good, bold, and plump, but not so good in color as Meerut wheat, the latter being whitish, whilst the former is yellow, and worth about Rs. 2-15. The samples marked L G 1 2, 3, like the former are not sufficiently marked in character to separate, so I treat them as one sample. The wheat is damaged and spotted, with much grain discolored, and would not sell for shipment hence in consequence, but would be bought only by the local retail dealers. It is worth about Rs. 2-8 a maund.

"W. H. Cogswell."

Garden.

There is nothing very particular to record under this head; steady progress has been made with the work indicated as more urgent by the Garden Committee. The remains of a shed near the dwelling-house has been removed, roads rolled and weeded. The gaps in the wall have been rebuilt, and levelling the lawn taken in hand. The propagator, whose appointment was confirmed at the last meeting, has been doing good and satisfactory work, and has now a large stock of roses which should be ready for distribution at the usual time at the end of the rains.

The new sorts of Achimenies got out last year are looking strong and healthy. The attention of members is drawn to the large stock of mahogany plants now in hand, upwards of 1,000 being ready for immediate distribution. There are also a large number, about 1,000 seedlings, of Arabian coffee available, some young Indian rubber plants, a few teak, divi-divi, and a large stock of fruit grafts, mangoe, lichee, and peach, &c. A potting shed for use during the rains is in course of erection from materials, most of which are available in the Garden, so the expense will be trifling. Since the last Meeting the garden has been visited by a severe storm which snapped off some twenty feet from the top of the fine young Eucaplytus tree south of the lawn, and uprooted one or two other trees, but no great damage has been done. There have not been many cash sales as usual during the hot, dry season. The new orchid-house is well filled with plants, and a large quantity of finely screened ashes were obtained and laid down, giving a firm, dry, and pleasant flooring. An experimental sowing of early Amber Sugarcane (the seed of which was presented by Captain Pogson, and noticed at the last meeting) resulted in a failure, only a few seeds having germinated. A great quantity of brick rubbish has been collected from various parts of the garden, as it rendered digging, &c., difficult, and was very unsightly. Arrangements are being made to sell this as road metal, the proceeds to be used to buy "kunker" for the garden roads; this will be cheaper than making it into material on the garden.

Rice-Husking Machine.

In the Proceedings of the 27th September 1882, the following allusion was made to a Rice-Husking Machine.—

"A model as used in the West Indies by the Chinese has been constructed by the order of Mr. W. H. Cogswell from a rough sketch kindly furnished by Mr. H. A. Firth, and it has been determined to give the same a practical trial shortly, with a full report thereon, so that its usefulness may be generally made known."

The model is apparently of the full size and stands 2 ft. 9 in. high; it consists of an upright shaft or column of hard wood, the upper face of which is cut into deep grooves radiating from the centre where a strong pin is fixed; the grooves are quarter of an inch in breadth and one-eighth in depth; a heavy disc of hard wood similarly grooved and of the same diameter is made to revolve rapidly, the central pin being the axis; paddy is poured into a receptacle on the top of the revolving disc, and falls out in the form of rice and husk into a circular trap affixed to the shaft. Grain is then separated from the chaff, either with a winnowing machine, or by the very effectual native hand process. In making such a machine for use in India the upright shaft might be dispensed with and a heavy block of wood substituted, so that the top of the revolving disc would be within reach of the manipulator when seated in the only position a native of India seems able to work in. This would also reduce the price somewhat, as the tray, too, could thus be dispensed with, and the rice would be allowed to fall directly on the floor. In whichever way it may be made, the machine is so simple that any common village carpenter could make one at a very trifling cost.

The result of the trial against the "dheki" and upcountry "ukhli" is given below. It may be proper to note here that the dheki has one advantage over the rice-husker, *viz.*, that the rice, after being husked and winnowed, can be repounded, and the brown marks which will always be found on rice thus removed; this process whitens the grain and brightens it considerably,

making a difference of some three or four seers in the rupee in the marketable value. It is, however, to be remarked that should this be considered necessary, the rice can be put under the dheki after being husked in the machine, at a great saving of time and cost. It need scarcely be said that the whitening process involves a loss in weight.

The machine has a marked advantage over the primitive native methods when "aroоah" or unboiled paddy is dealt with, as the difference in breakage, as noted below, is then very appreciable, and when it is remembered that a great number of up-country natives object to "usna" rice (made from boiled paddy) its advantage over the dheki and ukhli in this one respect alone should make it sought after, leaving out of consideration its other advantages which a glance at the table given below will show. It is of course for consumers to decide which rice they prefer, but aroоah (unboiled paddy) rice would seem a somewhat more cleanly article than usna (boiled paddy) rice boiled with water, to the quality of which the majority of consumers are as a rule profoundly indifferent.

RESULTS OF TRIALS.

	No. of men.	Time (minutes.)	Paddy.	Rice.	Husk.	Waste.	% Broken Rice.
	BOILED PADDY, "USNA."						
			Seers.	Seers.	Seers.	Cht.	
Rice Husker ...	1	17	5	3·12	1·1	3	18¾
"Dheki" ...	2	38	5	3·10	1·2	4	81¼
"Ukhli" ...	2	22	5	3·8	1·2	6	81¼
	UNBOILED PADDY, "AROOAH."						
Rice Husker ...	1	17	5	3·10	1·3½	2½	37½
"Dhoki" ...	2	24	5	3·6	1·5	5	93¾
"Ukhli" ...	2	25	5	3·10	1·2	4	31¼

In the above table the column "broken" includes all rice however slightly broken or even chipped, hence the very high percentage.

OFFICIAL PAPERS.

AGRICULTURAL EXPERIMENTS CONDUCTED BY PUNDIT AJUDHIA PRASHAD.

From PUNDIT AJUDHIA PRASHAD, Illaquahdar, Indalpore, and Shahjahanpore,—To W. C. BENETT, Esq., Director, Department of Agriculture and Commerce, N. W. P, and Oudh, Cawnpore,—dated Indalpore, the 15th of June 1883.

SIR,—1. In forwarding to you a report of the agricultural operations carried on by me during the year 1882 and 1883, I shall not trouble you with a minute account of the procedure which is pretty much the same from year to year, but I shall confine myself only to such particulars as are, owing either to their novelty or importance, specially deserving of interest and attention.

2. About the *kharif* crops therefore I have not to notice much, saving that I tried a peculiar sort of *urd* called *sarahra*, in fields that had received deep ploughing. The resulting outturn was exceedingly good, and the *urd* produced carried the first prize at the Golagokurn exhibition.

3. My *urung*, too, this year was of an unusually superior sort, and on samples thereof the first prize at the aforesaid exhibition was awarded.

4. *Rabi.*—In my report last year I gave a table showing that the outturn yielded by the Mozufferpore soft white wheat was better than that given by the other kinds sown here. Emboldened by this feature of the experiment I tried the soft white variety very extensively in the season under report, sowing it over 93 beeghas in all my five farms. The outturn fully supports the conclusions I had previously arrived at. An exceedingly satisfactory result of this extensive experiment is, that the zemindars of the neighbouring villages and the asamees generally have come to understand that the cultivation of the soft white wheat is more remunerative than that of the ordinary kinds. Accordingly I have been requested by many people to supply them with seed, and I doubt not but next year I will find the cultivation of this variety more extensive and general.

5. I am also now in a position to state my opinion as to the utility of picking the seed before sowing it. All the soft white wheat seed that was sown at Indalpore (Farm No. 1,) last year was carefully cleaned and picked before it was taken to the field. The fields sown with the seed so treated, beat the other fields sown with the same sort of wheat without the special treatment. In those sown with the picked seed the produce was fully double that given by the fields in which the ordinary *katha* wheat was sown Not only was the outturn larger in quantity but it was also better in quality. The grain produced by the picked seed is larger, whiter, and better flavored than that produced by the ordinary method of sowing. So far as this experiment goes, I can confidently state that picking and cleaning the seed before sowing is one of the essentials that result in the production of large outturns of extra superior quality.

Seed supplied by the Department of Agriculture and Commerce.

6. *Cape Oats.*—I tried the five seers of Cape oat seed that was supplied by your department. The produce equals that of the country barley, but the grain produced is inferior. It is also with the greatest difficulty possible to grind the oats by the ordinary flour mills (*chakkees*) and hence it would not do to cultivate this variety as a food crop. No doubt it would be very good as fodder, but then fodder artificially cultivated is not a desideratum in these parts, because the jungle and plains bordering upon the villages are full of the most luxuriant grass which supplies the cattle all the year round with food. It is my opinion therefore that the cultivation of these oats can never be universally adopted here.

7. *Guinea Grass*—I tried it in the valley of the river Goomtee as proposed last year. The shoots came up very well, were healthy and promising, but the sudden overflow of the river submerged and killed them. I cannot therefore confidently state whether the grass will succeed here. I will nevertheless try once with the proper precautions, and hope to be able to give my opinion about it after the next trial.

8. *Maizes.*—Of American maizes I received five varieties from your department in 1881. I tried them year after year as *khareef* crops. I did not, I am sorry to say, succeed at all in the experiments. Few cobs ever came to maturity, and those that did, bore very inferior and degenerated grain. I however persisted in sowing the deteriorated grain simply to save a little seed. In these repeated trials of mine the seeds of the different varieties got mixed, and I ultimately found that on gathering the cobs, some were produced that differed from the original seed in shape, color, &c. While trying to account for the appearance of these new varieties, it suddenly struck me that perhaps when flowering the plants of different varieties had fertilised each other and had thus produced new hybrids. Meanwhile at the beginning of the season under report your department sent me two varieties of American maizes, namely, white flint corn and yellow Canada corn, for trial as winter crops. I suddenly thought of trying my own deteriorated seed along with the new one as a winter crop, and wishing at the same time to test the fertilisation theory that I had previously arrived at. I followed a peculiar plan in the cultivation. I sowed the seed obtained from your department in long lines, and on either side of those lines I sowed my own deteriorated seed. Owing to the proximity of the different varieties one to another, I thought that fertilisation would be helped a great deal, and when the plants flowered, I shook them in all directions. The result was that when the crop ripened and the cobs were gathered, many new varieties were found; some of these possessed exceedingly beautiful and characteristic colors. The experiment on the whole was a thorough success, the grain produced being superior to the original seed sent to the Golagokurn exhibition, and all the gentlemen that saw them there were surprised at the largeness of the grain. I intend next year to sow each cob that exhibits a peculiarity in shape or color separately by itself, and will then report the result of the trial.

9. *Sugar-cane*—I reported last year the new system that I had adopted in dealing with tenants, namely, that of purchasing cane from them, and crushing it for myself instead of buying ready pressed juice. The success that I had last year induced me to extend operations in the season under report, and I accordingly started two *rab* factories. One as usual worked at Indalpore, and the second was opened at Januri, a village of mine near Tilhar. The system of selling cane is gradually getting into favor with the *asamees*; they are, as is well known, averse to innovation and are very chary of adopting things unless they are thoroughly satisfied of the profit likely to result. Gradually they are learning to appreciate the system of selling cane.

10. Repeated experience in cane cultivation has taught me a thing which would benefit those that try sugar-cane. The plant is propagated by cuttings which are of two sorts—1st, Khundwan, and 2nd, Agvahea. The first is obtained by taking the clean cane, and chopping it up into portions about a foot long. These bits are placed in the field and give off-shoots. On the second system the whole of the cane is not utilised for cuttings, but the crown top alone is taken, and that is placed a few inches below the soil in the prepared field. Now although both these systems are followed, my experience causes me to prefer the second sort of cutting, as because it is tender, it germinates very soon and also gives off a very large number of shoots. On the other hand the Khundwan sort are very tough, and as they are full of sweet juice, are in great danger of attack from white ants. It is therefore advisable to use the Agvahea or crown top cuttings as far as possible and to avoid using the Khundwan ones.

11. I must also in this connection note the fact that deep ploughing does enormous good to sugarcane as well as to other crops in general. I stated this fact in my reports of past years, but I now do so again as year after year my belief in its efficacy gains greater strength. One good feature and a rather important one is that sugar-cane grown on deeply ploughed land withstands drought more than that grown on lands that are not deeply ploughed. Besides, all this deep ploughing does not only give greater outturns, but permanently improves the land. A remarkable instance of this result of deep ploughing is seen in one of my villages called Hetinanagra. During the past years owing to a variety of causes the asamees gave up cultivating a large area of land in that village and this put me to great loss. I some years ago

opened a farm there and cultivated almost all of this land for myself. I used the improved ploughs and thus all the fields in time began to [illegible] *asamees* now think the fields to be very good [illegible] want them back; they are even willing to pay larger rent. All [illegible] improvement in the land I can only attribute to deep ploug[illegible] the introduction of systematic farming.

Process of making Sugar from Rab.

12. I stated the *bel* process of making *rab* last year, and I would now like to give a short description of the method by which *rab* is made into sugar. The process is divided into 2 parts. The Kursees or clay pots full of the *rab* are taken to the Khundsar, and two or more workmen take charge of them. There is an oblong structure with walls about a yard high called *channee* the interior of which is lined with a blanket, before which the workmen stand. Each of them lays hold of one pot, lifts it up, and places it on the wall of the *channee* and then by means of the thick handle of a little *Khurpee* knocks off the upper half of the pot. Then by means of the flat Khurpee he scrapes and throws the *rab* into the *channee*. This operation is conducted until it is thought that an amount of *rab* sufficient for the day's work has been thrown into the *channee*. Through the blanket which lines the interior of the structure, a part of the molasses of the *rab* filters and passes by a drain into the hole intended to receive it, represented at the left of the figure. Each workman is then provided with 12 bags made of coarse blanket stuff into which he fills the *rab* from the *channee* and ties the mouth with bits of rope. These he arranges in a vertical pile on a structure known as the Khurea in the drawing, and then places a heavy cylindrical block of mud on the top of all. Straight rods of bamboo (about 1½ inch thick and 1 yard in length) are attached to the pile of bags to keep it steady, and then the workman mounts on to the top of the pile supporting himself on a cross beam represented in the figure, and shakes the pile backwards and forwards and pressing with all his might on to it. Owing to this pressure the molasses flow out of the bags and fall to the bottom of the Khurea whence by a drain they pass into the *mund*, a pit well plastered with mud and *bhusa* which is constructed near at hand to receive them. If the *rab* is tolerably good, it is thus manipulated for about six hours, after which the bags are removed from the Khurea, opened, shaken about, and re-arranged in the self-same way. The pressing again commences and is carried on till the evening when the pile is left, for the night. In the morning the bags are opened and the *rab* with which they were originally filled is by this time converted into *putree*.

The second part of the process then comes into play. In a small room, an oblong enclosure is made by means of thatching straw *tattees*. Bricks are arranged on the floor of this enclosure and then a thick covering of reeds (*sethas*) is laid on them. A cloth called *pullea* is then spread over the whole, and then the *khanchee*, as it is termed, is ready to receive the putree. The *khanchee* is filled with *putree* and its upper surface is smoothed. A thick layer of (*siwar*) river weeds, is then spread on the top, and this is allowed to remain for a few days. The *siwar* is then removed and to a certain depth—an inch or so, the *putree* is found to have turned perfectly white. This portion is scraped off by means of iron instruments called *kurchulas*. To the newly exposed surface another covering of *siwar* is applied and from day to day the application of the weeds and the scraping are carried on alternately. This scraped sugar termed *puchnee* is spread on a piece of coarse canvas (*pata*) which is placed in some place exposed to the sun, and a few laborers tread over it and rub it with their feet. This operation dries the sugar and makes it white, and thus is formed what is termed *khand*. In this form the sugar manufacturer sells his produce. When required for use, this *khand* is made into syrup which is boiled and clarified by the addition of milk and *ghee*, and is then allowed to thicken, care being taken to prevent crystallisation by rubbing and beating it with wooden instruments, shaped like thick spades. It then gets the name of *chini* or *bura*.

13. There are a few bye-products that need notice. After the *puchnee* is scraped off the *khanchee*, the surface of the latter is carefully broomed and little bits of the weeds steeped in sugar are gathered. These are accumulated and when sufficient in quanity are soaked in water and the syrup thus obtained is boiled. It thickens to the consistence of *rab*, and has a peculiar flavor. It is generally reserved by the manufacturer for home use, and goes by the name of *chota rab*.

14. When the *khanchee* is emptied the reeds that were laid at the bottom are found covered with thick white crystals of sugar termed *papri*. These are generally consumed by the manufacturer himself.

15. The cloth *pullea*, the reeds and the bricks laid at the bottom of the *khanchee* are then washed in water, and the solution is then boiled and converted into little oblong cakes of sugar termed *kutree*.

16. The molasses that flow out of the *khanchee* are of two sorts. When the *khanchee* is first filled with *putree* for a few days a thick sort of molasses flows out ; this is called *kutchea* and is sold along with the ordinary *sheera*. After a few days the molasses becomes thinner, and then gets the name *garaot*. This on being boiled is converted into a thick sort of inferior *rab*, which, on being subjected to the process of clearing and filtering above described, yields a sort of inferior sugar.

Implements.

17. *Boiling Pans.*—In my report last year I noticed the many shortcomings of the rude iron pans used for boiling sugarcane juice, and I also stated that at the suggestion of Captain Clibborn I applied for cast-iron pans from your department. You were pleased to suggest that I would be a loser if I used cast-iron pans, because in the course of a few years the iron would oxydise, and would then be comparatively of little or no value. You at the same time thought that copper would be a better material to use. Five copper boilers were accordingly made under the supervision of your department, and I used them in making *rab* last year. The result of the experiment is exceedingly gratifying. The *rab* produced contains a less amount of molasses than it used to do, and at the same time is better in grain and color. This superiority I can only attribute to the use of these pans, as owing to them, heating of the juice was more equal and steady, and all the application of the bell fruit, *urd* flower, &c, things that disfigured the *rab*, was avoided. Many people came to see the pans working, a greater part of them were sugar-growers and they all agreed as to the usefulness of these pans. At the Golagokurn Exhibition I saw an American sugar-boiler that was exhibited by Major Pitcher. The apparatus was exceedingly economical and efficient, and I doubt not but that it would be of great service here. If it were possible to obtain a few such boilers manufactured at your workshop, I would be exceedingly glad to obtain four or five of them, wherewith to extend operations next year. If they cannot be had, I will be obliged to be under the necessity of applying to you for another set of copper pans like those which Major Pitcher so very kindly constructed for me last year. It is impossible for me to get them done here, and I will not like, after using pans of this and the better sort, to revert to the rude country ones, so that I will be obliged to trouble you for another set.

18. *Martin Ploughs.*—Two ploughs of this sort were very kindly supplied to me by Mr. Mulock for trial. I have used them, and find them to be very light and cheap. The ordinary cultivators like them very much as they can be worked by common bullocks. They were made at Shahjahanpore and cost Rs. 2, annas 4 each, which is really very cheap, and places them within the reach of almost every one.

19. *Behea Sugar Mills.*—I have continually been trying these mills and worked twelve of them last year. The contemplated extension of work will, I hope, necessitate my buying a few more. I consider it now needless for to me state that I am thoroughly satisfied with these mills, as I think their superiority has now been very well established.

20. *Threshing.*—Repeatedly I have found the absence of a proper apparatus for threshing corn, one of the most injurious and troublesome difficulties that besets one who attempts agriculture on a large scale in these parts. A man spends a lot of money on his fields, goes to the trouble of watching, irrigating, and otherwise looking after them, mows his crops,and thinks that he is now about to realise the fruits of his labor. All of a sudden falls a shower, the *bhusa* rots and become worthless, and hundreds of maunds of grain is spoiled. This state of things is exceedingly painful. I met with severe losses in this way in the last *rabi* season. I, and I may safely say all those that try agriculture largely, would be exceedingly grateful could some remedy be suggested. An efficient threshing machine is a desideratum the want of which is very painfully felt. At the Golagokurn exhibition I saw a machine called the Indian corn-shelling machine. I am of opinion that it could with some modification suit the purpose of cleaning Bajra very well and would then be exceedingly useful in these parts, as Bajra is one of the principal staples grown here in the *kharif* season.

21. *Cattle.*—With regard to the Canwarea bull I have to state that it is doing very well. During last year I had sixteen calves in all from him, and there are 30 more in the village. They are very beautiful and promising, and there is every prospect of their maturing into fine cows and bulls. I think that the plan I followed of allowing the bull to run and remain unrestrained along with the kine is very successful.

22. *Donkey Stallion.*—The stallion remained with me for more than a year—but the climate for this place did not seem to agree with it, so that I was ultimately obliged to send it back to the stud department. There are one or two young mules here, but the people it appears do not care to breed mules.

23. *Salotri.*—In July 1882, I wrote to you telling you of the fearful mortality that then prevailed among cattle here. You made my letter over to Major Pitcher who very kindly sent me a salotri that reached me in September 1882. He treated 387 cattle in all, out of which he was successful in 347 cases. In 29 cases he failed, and the cattle died, and of 11 cases the result was unknown. I must say that with regard to the treatment of wounds and in surgery generally, he was exceedingly successful, but I am sorry I cannot say equally well of his treatment of the disease for which he was specially sent for. I do not know the technical name of the distemper, but when afflicted with it, the animal suddenly becomes unable to move, is purged fearfully, and continually vomits greenish water. The *salotri* called this disease cattle-pox, and although successful in one or two isolated cases, signally failed in doing real good. The natives called this disease *rei*.

24. In connection with cattle and their diseases, I must notice the thorough and complete success that resulted in almost every case in which I experimented with Jeye's Purifier. This medicine acts wonderfully on the wounds and sores of cattle, and cures them in almost no time. It destroys vermin instantaneously, and was of great use to me in my sugar factories, where it promptly destroyed the big black ants that attack sugar in myriads and do lots of injury. I found it equally successful in healing the wounds and boils of men.

25. *Mulberry Cuttings.*—Thinking that the sandy nature of the soil here was suited to a growth of mulberry, I applied to the Superintendent of the Botanical Gardens, Shahjahanpore, who sent me 300 mulberry cuttings. I planted them and they are thriving. I will transplant them to the river side in the ensuing rainy season. Ultimately, I intend starting some experiments in sericulture.

26. In conclusion, I must offer my sincere and heartfelt thanks for the ready assistance and kind advice that I have always received from yourself and Major Pitcher.

I have the honor to be,
Sir,
Your most obedient Servant,
AJUDHIA PRASHAD,
Illaquahdar of Indalpore, &c.,
District Shahjahanpore.

MR. SABAPATHY MOODELLIAR'S AGRICULTURE EXPERIMENTS.

THE following is a report from Mr. W. R. Robertson, M.R.A.C., Agricultural Reporter to the Government of Madras, to the Director of Revenue Settlement and Agriculture, Madras, dated Saidapet, 23rd January 1883 :—

"In the early part of last month, I availed myself of the permission granted me in the Proceedings of the Board, dated the 9th October last, to visit Bellary and inspect the agricultural operations conducted there by Messrs. A. Sabapathy Moodelliar and Co., and I have now the honour to submit my report on that inspection. Messrs. A. Sabapathy Moodelliar and Co.'s operations have extended over a wide area of country. In 1881, the area worked by the ploughs they had introduced was 1,900 acres situated in 10 different villages ; while, last year, the area was increased to 3,430 acres situated in 17 different villages. Opportunities have thus been afforded to a large number of ryots for witnessing these important experiments, as the villages in which the experiments were conducted are scattered over a tract of country fully 30 miles wide. The portions of this land that I inspected are situated near Hagari and near Bantanahal. In my inspection of the land at the former place, I was accompanied by the Collector of the district, and we were conducted over the land by Mr. A. Sabapathy Moodelliar, Mr. Sabapathy Iyer, and Mr. Firth. In inspecting the land at Bantanahal, I also had the benefit of the company of Messrs. Sabapathy Moodelliar and Firth. Before proceeding further, I must express the very great obligation I feel under to these gentlemen for the trouble they took in accompanying me over the land inspected, and for the full and valuable information they placed at my disposal. I fear (in the great interest I felt in what Mr. Sabapathy Moodelliar had done, and is doing), I somewhat transgressed the bounds of fair inquiry, for it must be remembered that the enterprise is entirely of a private nature ; but if I did do so, it was not resented, for not only was all available information fully afforded to my inquiries, but it was given in a way to suggest other and further questions. The chief circumstances which induced Messrs. Sabapathy Moodelliar and Co. to give their attention to the introduction of improved ploughs for working the cotton soils of Bellary having been noticed at length in the General Report of this department for 1881-82, at pages 14—16, it is unnecessary to notice them again here. Messrs. Sabapathy Moodelliar and Co. have, for some time, been largely interested in the cotton trade of the district, and are now extending their operations to spinning and weaving cotton, and are constructing a large mill for these objects in the town of Bellary. A regular and full supply of cotton, of a good quality, is therefore a matter of considerable importance to this enterprising firm—objects quite sufficient to explain Messrs. Sabapathy Moodelliar and Co.'s interest in, and their desire to improve, the husbandry of the district. But, I believe, Mr. Sabapathy Moodelliar is influenced by other objects than mere personal gain, highly laudable as such an object would be. He has long been connected with the district, is familiar with a considerable part of it and the people of the cultivating classes, and has noticed with concern the gradually increasing poverty of the people and the less and less care devoted to the tillage of the soil—influences which, in a season of great drought culminated in the famine, which so recently devastated the district, resulting in a loss of one-third of the population and the abandonment of nearly one-third of the arable area. Mr. Sabadathy Moodelliar has deeply considered this and other circumstances bearing on the state of agriculture in Bellary, and has fully convinced himself that it is the imperative duty of all men possessing wealth, who have any interest whatever in the welfare of the district, to use some of that wealth and what influence they possess in promoting whatever may tend to further the interests of husbandry. Mr. Sabapathy Moodelliar looks upon this duty in the same light as many others of his countrymen who possess wealth do on the duty to provide choultries and similar institutions for Brahmins and other castes, but that the duty to promote the agriculture of the country is of paramount importance—a view in which I venture to believe all will concur who possess any real knowledge of India and its husbandry, and who desire to see the country prosper. Messrs. Sabapathy Moodelliar and Co. have introduced into this district the undermentioned ploughs :—

Swedish ploughs	334
Improved wood and iron ploughs	60
Ransome's double ploughs	5
Do. triple furrow do.	1
Do. four-furrow do.	1
Total ...	401

They have already sold 132 of the Swedish ploughs and all of the Ransome's double ploughs. Some of the ploughs were sent to the Nizam's Dominions, the Mysore Province, a few to the Kurnool District, and to the Dharwar District in the Bombay Presidency. Thus the good influences set in operation are extending widely. Judging from the great gatherings of ryots I saw, and the great interest they appeared to evince, at Bantanahal and elsewhere, where the ploughs were exhibited at work, or the land that had been ploughed could be seen, Mr. Sabapathy Moodelliar is apparently doing much good in the district. It was a great pleasure to accompany him over the land, and to witness the interest with which the ryots listened to his remarks, and the apparent pride they took in the superior crops raised on the deeply-ploughed land. I am convinced that the movement is entirely spontaneous on the part of the ryots, and is due simply to their appreciation of the quality of the work done under Mr. Sabapathy Moodelliar. The plough in most request is a Swedish Plough No. 16, which after being strengthened is sold at Rs. 65 each. Though it is, I think, the largest and heaviest plough that has ever been introduced into this part of India, the ryots, in their appreciation of the deep-going power of the plough, sometimes drive it much deeper than it is intended to work, and the consequence has been that in several cases the powerful beam of the plough has been bent ; but Messrs. Sabapathy and Co.'s Workshops have proved equal to this emergency, and the ploughs of the kind now sent out have first their beams strengthened by iron plates. The ploughs are sold to ryots either for payment in cotton, for cash, or on credit for 4 or 8 months. In some cases, the ploughs are lent on hire at Rs. 10 per month. Ploughing to an average depth of from 10 to 12 inches, these improved ploughs are said to do the undermentioned work per day of 8 hours :—

	Acre
Land in a very dry state	0½
Land in a moderately dry state	0¾
Land in a very good state	1

Mr. Sabapathy Moodelliar estimates that he can, when the land is in good condition, plough with his large plough, from 10 to 12 inches deep, with 4 pairs of cattle, at a cost of about Rs. 3 per acre, whereas he could not with the large country plough get as good work done for Rs. 8 per acre. I should consider, from what I saw done, that the large country plough would do a shorter length of furrow than one of the improved ploughs, and that one operation of the latter is equal in effect to two of the former. Ploughing a furrow 12 inches wide, an improved plough would have to travel 8 miles to perform one acre of ploughing, but 20 per cent of the time would be lost at the headlands in turning ; the useful day's work would therefore be 4·8 hours ; the cattle would thus need to travel nearly 2 miles per hour—a much faster speed than usual. I certainly saw some of the ploughs worked at a speed as great, but it was only for a short time, and could not be kept up during a day. Probably, therefore, three-fourths of an acre may be taken as a full day's work with one of the improved ploughs when the land is in really good order. The country plough could not get over more than two-thirds of an acre per day, under similar conditions, and would need to go over the land twice : its effective work would therefore be one-third of an acre per day, and three days would be occupied to do on acre with six pairs of cattle. No bad results have followed one deep-ploughing these black cotton soils, as far as is known ; the fact is, that the cotton plant is the chief crop and its deep roots prepare the soil for deep ploughing. Messrs. Sabapathy Moodelliar and Co. have ample facilities for repairing iron ploughs at their Cotton Presses, of which they have eight in different parts of the district. They trust to be able to make iron ploughs ere long. Much of Messrs. Sabapathy Moodelliar and Co.'s land is worked on the share plan, that is, they pay rent, provide manure, the ploughs and the seed, and the cultivators find the manual labor and cattle labour, and get from one-twelfth to one-sixth of the cotton yielded for harvesting it, while half of the remainder goes to Messrs. Sabapathy Moodelliar and Co. as their share : they are satisfied with the arrangement, and would be glad to get a larger area of land on the terms on which they hold much of that they now have. It appears to me much better that land should be thus utilized, instead of lying waste ; there would be no difficulty in drawing up an "improving lease" to secure the interests of the State. All new enterprises are uncertain at first, and if capital must be attracted to agriculture, some inducements must be held out, and Messrs. Sabapathy Moodelliar and Co.'s plan of providing capital has much to recommend it. This district appears to demand exceptional treatment if it is correct, as is asserted, that in the past 10 years, the population has diminished one-third, while there is one-third less land under cultivation. Mr. Sabapathy Moodelliar does not confine his attention to deep culture ; he is quite aware that, though deep culture is one of the most effective means at the command of the former for improving the outturn of his farm, it is only one of the means that are available for securing this desirable object. He is giving attention to the *one* manure, so abundant and yet so little used in India, *viz.*, poudrette, has made arrangements with the Town authorities of Bellary, Adoni, and Cuddapah for obtaining supplies. Last year he manured a considerable area of black cotton soil with this manure, at the rate of about one ton per acre. The results were very satisfactory, but he considers that the rail charge is too high for such bulky manure. The rate appears to be 5 annas per waggon per mile, and the consignee loads and unloads the manure. The rate does not appear to be excessive, for it is only about half-an-anna per ton per mile. Certainly the so-called poudrette usually made is so poor, it will not bear the cost of distant carriage ; it should be used only near the places where it is collected and prepared, or be made into a more concentrated manure. Messrs. Sabapathy Moodelliar and Co. consider that the land manured with poudrette last year shows this year also a marked superiority over the unmanured land ; and the portions I saw certainly bore out this conclusion. Messrs. Sabapathy Moodelliar and Co. are, I understand, making arrangements for collecting and

crushing bones for use as manure. It is not only in cultivation and manuring that Mr. Sabapathy Moodelliar is taking such a leading part, but in the introduction of cotton seed of superior kinds; he understands that a deeply-tilled and well-manured soil can be much better employed than in growing inferior, indigenous cotton. He has therefore imported into the district large quantities of the following varieties:—Coimbatore, Hingunghat, Broach, Dharwar, Tinnevelly and Dhollera, with which most of the land he holds is cropped. Mr. Sabapathy Moodelliar is a firm believer in thin seeding, and has his cotton seed sown at the rate of only about 7lbs. per acre, in lines wide apart. He discourages as much as possible the culture of crops between the lines of cotton, in order that the cotton plants may benefit fully from the soil. My own opinion is that his anxiety on this score is unnecessary, if care is taken in selecting a suitable crop for growing between the lines of cotton, for during its early growth cotton does not need much from the soil, and a cereal crop may be grown and removed before the cotton needs the whole of the land; of course, when both coton and a cereal crop are grown on the same land, more is demanded of the soil, and it must therefore be manured more highly than if cotton only is to be grown. The crops I saw on Messrs. Sabapathy Moodelliar and Co's land were almost invariably much better than those of the adjoining land. In passing through the country, it is quite easy to discern by the crops the fields that have been deeply ploughed. Last year the cotton crop was very bad in Bellary, owing to the failure of the rains, and the average outturn on Messrs. Sabapathy Moodelliar and Co's land was only about 37½lbs. of clean cotton per acre; but adjoining lands treated in the usual way did not give 10lbs. per acre. One or two fields of low situated land gave over 100lbs. of clean cotton per acre. Judging from the appearance of the crops when I saw them, the outturn this year will be very much larger than that got last year. The absence of a variety in cropping is a great evil in the Bellary district, and Mr. Sabapathy Moodelliar appears to recognise this fact; he is doing what he can to introduce other crops on the black soil, such as wheat, sugar-cane, indigo, and fibre crops. Mr. Sabapathy Moodelliar has shown a practical interest in agricultural education in having given employment to two or three graduates of the School of Agriculture in connection with the enterprise under notice, and he is a warm advocate for a status being accorded to agricultural education equal to that of medical and engineering education. Before concluding this report, I wish to bring to notice one or two points which specially attracted my attention while in Bellary: first, the necessity for screens, in the shape of plantations or fences, for sheltering stock and crops in severe weather; at certain seasons of the year, when the cold wind prevails, which sweep over these treeless plains, farm stock suffer severely. Efforts should, I think, be made to induce those interested in the land, who possess the means, to do what they can to raise screen fences or plantations. Some portions of the district where mixed soils prevail are not unlike the country around Erode, in the Coimbatore district, where a hedge shrub is grown largely known as "Moollukiluway," which is an excellent shrub for forming fences either for shelter or for enclosing crops. I have arranged with the Sub-Collector of Erode for a supply of cuttings of this thorn plant to be sent to Bellary at the proper season, but there are probably other shrubs equally well suited. Another point of interest is the water-supply for man and beast. I heard of instances in which, even in a good season, villagers have to send as far as five miles for their daily supply of water,—due, in some instances, not so much to the absence of water, but to the water of their wells having become so saline as to be unfitted for drinking. Wells, which at one time contained good water, are now for this reason abandoned. It would, I think, be a great boon to the people in many places, if, in the dry season, a small portable engine, with a centrifugal or other pump, could be sent by Government to the accessible places for employment in emptying some of these wells, which cannot in many instances be emptied by the means at the disposal of the people. I believe that in most instances the increase in the quantity of salt in the water of these wells is to be attributed simply to the concentration of the salt brought in the natural spring water due to the loss of water by evaporation over a term of years, and that, if the comparatively speaking concentrated solution of salt in the wells be removed, and the wells be thoroughly cleaned out, the fresh supplies of water when the springs have come thoroughly into play will generally be fitted for drinking. The experiment is, I think, one well worthy of trial, for, if successful, much good would result. But more than this is necessary; new wells are greatly required, both for enabling the people to get water for themselves and their stock, and for raising crops and trees where the soils are suitable. I venture, therefore, to invite attention to the suggestion I made in my report on the Coimbatore district relative to the employment of a few squads of men in boring for water in different parts of the district where water is especially required and is likely to be met with. There are other points of interest connected with the improvement of the district, but they need more careful local investigation than my short visit permitted.

The Director of Agriculture remarks on this report:—"Referring to the *metayer* system adopted by Mr. Sabapathy in his agricultural operations, Mr. Robertson appears to advocate the adoption by Government of a similar method, so as to bring into cultivation a large area of land that is now lying waste. But not to speak of the fact that the *metayer* or sharing system, however successfully it may be worked by a private owner, has been discredited everywhere by Indian history as a Government method of agriculture and revenue, there remains the fact that the lands now waste are so chiefly from the want of people to cultivate them. Rather less than a quarter (not a third, as Mr. Robertson puts it) of the population of Bellary disappeared with the famine, and something less than a quarter of the land in occupation before the famine is now lying waste and unoccupied. The people of India are not migratory, and it is improbable that these waste lands will be occupied by immigrant settlers. Mr. Sabapathy's experiments with poudrette are said to have been very satisfactory, but the report of them would have been more interesting and useful if accompanied by comparative statements of results. Mr. Robertson's suggested remedy for the cost of carriage of this manure to places distant from where it is made, *viz.*, to make a more concentrated poudrette and to *use it only near the places where it is collected and prepared* is unintelligible, for the only purpose of concentration must be to fit it for carriage, while concentration is unnecessary if it is to be used only where it is collected and prepared. With reference to the planting of 'kiluway' hedges to screen crops and stock from blast, I have to observe that in Coimbatore it is necessary to supplement for some crops, such as the betel vine, the kiluway hedge by high screens of matting. I am afraid that the remedy for brackish wells proposed by Mr. Robertson in the the same paragraph 14 would have only a very temporary effect. The soil is impregnated with salts of various kinds, and these salts as they get dissolved infiltrate into the water. As the water gets low, the water of course gets more heavily charged. The only lasting remedy is to condense it—a thing easily done by people who know so well how to distil—or to get water from a lower stratum, but this would be generally possible only by means of artesian wells, and they are not always possible."

The Board of Revenue in submitting this report to Government consider that Mr. Sabapathy Moodelliar's efforts to improve the agriculture of the district where he resides are most praiseworthy, and he deserves every encouragement. It occurs to the Board that in two directions the Government might possibly afford valuable assistance to the people in such a district as Bellary. One is by showing them how to extract from the existing salts, which are so abundant in the soils, those nitrogenous elements which are the great desiderata in manures. Whether this can be done in a cheap and a practicable manner (if it can be done at all), and how it is to be done, are questions for a competent analytical or agricultural chemist, such as Dr. Nicholason or Mr. Harman of Bangalore, to decide. The Board believe they are correct in stating that at all salt factories a large amount of potential manures is lost in the mother liquors, which are thrown away from ignorance of their value, and, reasoning from analogy, it would appear that similar properties are to be discovered in the salts of the soil, which in their natural condition are usually noxious to vegetable growth, and by filtration into wells render the water undrinkable. The possibility of getting rid of the saline impregnation is therefore a matter of the deepest interest and importance, and the Board would urge on Government the desirability of having the subject scientifically investigated, considering it to be one on which funds might very advantageously be expended. The other point is the sinking of artesian wells, which has indeed lately received the attention of Government in the adjoining district of Anantapur (*vide* Board's Proceedings, dated 6th December 1882, No. 3024). More favourable conditions than those reported on for Anantapur would probably be found in the neighbourhood of Bellary; but it would be well to have actual experiments made by a specially-qualified person, acting in consulation with a geologist.

Order of Government, dated 16th June 1883.

The Government concur with the Board in considering Mr. Sabapathy Moodelliar's enterprise very laudable. The difficulty and cost of effecting repairs appear to be the chief obstacle to the more extended use of European ploughs. Mr. Sabapathy will be supplied with a copy of Mr. Benson's late report on Agricultural Implements suited for introduction into India, together with the order thereon. The Government do not entirely apprehend what is the proposal made in paragraph 3 of the Board's Proceedings, but any practical suggestion will receive their attention. It has been ascertained in the North-Western Provinces that barren saline lands can be reclaimed and their saline impregnations removed by planting *atriplux nummularia* (Salt Bush), and the Superintendent, Government Farms, has been directed to procure a supply of seed for trial at Saidapet. Possibly Mr. Sabapathy Moodelliar may wish to make an experiment at Bellary, in which case Mr. Robertson will supply him with some of the seed. The subject of artesian wells, the cost of which the Sanitary Commissioner believes has been greatly over-rated, has lately received considerable attention, and efforts are being made to discover suitable localities for borings.

SELECTIONS.

BEE CULTURE IN INDIA.

NOT having met with beehives in the plains during a long residence in India, it occurred to me that bee-keeping, as carried on in Europe and America, might be introduced into India with great advantage to the rural population. When in England I wrote to the India Office for any available information on the subject of Indian bees and apiculture. This led to the Secretary of State addressing the Government of India, and the Government of India sent out a circular to local Governments and Administrations asking for information on the subject. The local Governments having collected information and furnished reports, these reports have just been issued, with a Resolution of the Government of India on the subject.

The reports contain much information of interest and importance; but necessarily, from the nature of the subject, the writers in most cases not having the necessary knowledge as bee-keepers or naturalists, erroneous opinions are

expressed, and some facts of primary importance are so incompletely stated as to be of little value. Other reporters have given opinions which, however they might apply to limited areas, are inapplicable to the whole of the plains of India.

It appears the honey-bee is found all over India—some reporters mention six or seven kinds as indigenous to their locality; in all cases the bees are mentioned by native names, and as these differ, and the descriptions do not include the generic characteristics, the species cannot in most cases be identified, and in some of the cases, where scientific names are given, they are evidently wrong. It appears probable that varieties of the unicomb bees *A. Dorsata* and *A. Florea*, and the multicomb bee, *A. Indica*, are common over the greater part of India, Burmah, and along the Himalayan slopes; that some variety of *A. Indica* is the kind generally cultivated. This bee is similar in habits to, but not identical with, the European bee, as some have supposed. The bee being so generally diffused is evidence that it might be cultivated with profit over the greater part of India. Very generally it is kept by the natives in the villages in various parts of the Himalayas and of the Punjab hills and Cashmere in the walls of houses: in the Beas Valley hollow logs are used as hives, and moved from place to place to get the bees pasture; in the Khasia and Jaintia Hills hollow logs are used as hives, and these are thatched with grass. In Pegu logs are used, the ends of being covered with skin. The Nepalese, Bhutias, and Lepchas about Darjeeling use hollow log hives. Although it is reported that the natives of lower Bengal do not keep bees, I find they do keep them in earthen vessels inserted to the walls of the houses, and I purchase stocks of bees as I require them from this source. In many cases the bees are enticed into vessels or hives by putting these in suitable places during the swarming season. In other cases, as in Cashmere, the hives are stocked by capturing swarms in baskets, as in Europe. The Khasias capture the queen and tie her with a thread or hair to a stick on which the bees swarm, when they are carried away and hived by the owner or sold. The queen is tied in the hive to prevent the swarm absconding. On the Punjab hills the bees are fed, as in Europe, on sugar and flour during cold weather. Even the best native attempts are very rough and cannot be very productive. The honey is taken in most cases by using smoke to intimidate the bees; in some cases, with the smaller bees, they are driven out by the blowing into the cavity. A powdered plant is blown into the nest in Ganjam. The honey of the larger wild bees is usually taken at night, torches being held under the bees. In some places there is a belief the honey must be taken during full moon, or the bees make away with it; in other cases the idea is they make away with it if it is not taken on a dark night, as disturbed bees always fill themselves with honey if possible. It is obvious how these notions arise. In some cases the small kinds are merely brushed off the combs; in others the comb is put into a bag and all the bees destroyed. In many cases the face of the man taking honey is covered, and Assam ginger is chewed to keep off bees. The honey is harvested at certain times of the year, but it is noteworthy that there is usually more than one honey harvest during the year. In Haraoti and Tonk the honey is taken at the end of April and beginning of May; Coorg, May and June, but stated to be harvested several times a year; North-Western Provinces, twice, May and October; Sibsagar, twice a year, February and October; Khasia Hills, three times, twice in spring, once in autumn; Cashmere, twice, June and November, or December; Darjeeling, March, April and October. Near Calcutta I find honey is taken just before the rains in June. It is very difficult to arrive at the quantity of honey yielded by one stock of bees, and in comparing figures the identity of the bee is doubtful. In Burmah three pints of honey and 30 to 35 tolahs of wax are taken from a bee building in hollow trees. In the Central Provinces 20 to 25 seers of honey and 5 to 6 seers of wax are taken from a bee found in white-ants' nests. Four to five seers is taken in May, and two to three in October, in the North-West. In Coorg 5 to 20 seers. In the Wynaad *A. Indica* is said to yield 6lbs. three or four times a year. In Trichinopoly district a bee building in hollow trees yields 4½ to 18lbs., and in Ganjam the yield is 12 Ganjam seers. In Indore the yield is 16 to 24 seers for the large bees, and 8 to 12 lbs. for the smaller.

A Burmah bee half-an-inch long yields 24lbs. honey, 5lbs. wax; another 1 to 2 lbs. wax and two quarts honey. In the Khasia Hills six seers of honey are taken. But these figures are very rough approximations; in some cases the proportion between wax and honey is apparently incorrect, and in no case is there data to draw any conclusion upon as to what these bees would yield if properly treated. The best European varieties when wild in America *yield scarcely* anything as compared with what they yield when properly treated. In some places the larvæ of the bees are eaten: they are said to taste like cream. The Deputy Conservator of Forests, Salween Division, vouches for their being a most delicate dish when roasted and served on toast. If a taste for the roasted maggots should spring up, India would have the honour of supplying a new article of diet, and a profit would attach to an improvement in apiculture not thought of hitherto by the best authorities.

It is probable the bees swarm at more than one season of the year. More information is required on this most important point. In Sibsagar they swarm twice, *viz.*, in March and October; in the North-West they swarm in April; in lower Bengal I find they swarm in May or earlier, and I captured a fine swarm of *A. Indica* the first week in June. The treatment of the honeycomb harvested is abominable, the product is necessarily very inferior, and keeps badly unless specially treated; the pollen must in many cases give the honey an unpleasant flavour, and the fact that it was expressed with dirty hands or through a foul blanket, and that a vast number of larvæ were crushed with the comb, must make the honey unacceptable, to Europeans at least; while the knowledge that it is very generally adulterated must seriously impair the demand amongst natives. The methods employed are squeezing the comb in canvas bags or in a blanket twisted by two persons; squeezing by the hands, or in very few cases by means of a kind of large lemon-squeezer, considerately introduced by some gentleman in the Forest Department to prevent the filthy practice of hand-squeezing. As the honey is often not ripe, and is commonly foul, it does not keep; it is boiled thicker, or till scum ceases to rise, or it is kept in new earthen vessels with a very little wax. The *rationale* of the earthen vessel is probably the evaporation of the watery constituent and consequent ripening, as it is called in Europe. Boiling injures honey. In Ganjam the comb is not cleared, but broken up and sold no doubt—a dirty mess of wax and honey together. Wax is purified by boiling the comb and letting the water cool, or by squeezing the hot mass after boiling in a coarse cloth. The price the honey and wax fetch differs widely. In Coorg the honey fetches only 2 to 3 annas a pound; the wax sells for 5 annas 9 pie to 8 annas 8 pie, and is exported to Madras; at Kotagiri (Nilgiri Hills) honey is 12 annas to one rupee a bottle. In British Burmah honey varies from 2 annas to 10 annas. a lb, and wax 12 to 14 annas. Mr. Hunter of Landour tells me he gets 12 annas a pound, and demand is far greater than the supply. A description of honey, believed to be made from lotus flowers only, is used by native physicians in eye affections, and fetches a very high price. In many cases honey and wax are exported from the places where procured, as in the cases mentioned above, *e.g.*, from Mergui, was valued at Rs. 750 and honey valued at Rs. 8,000, the product of wild bees, is exported yearly to Moulmein and Rangoon; about 100 maunds exported from Ulwar into the British district of Gurgaon, &c. The revenue on the collection of wild honey is very trifling. In Coorg it is about Rs 270 a year, but several Forest Officers think the revenue from this source might be increased. In Cashmere all honey on Government tracts is the property of the Maharaja. Rent is paid to the house-owners who maintain the hives; 'when lands are leased a cash value is fixed and added to the Government share of the revenue due; when the Government share is collected by division of harvest, two-thirds of the honey is appropriated by the State, and one-third by the zemindar. It is stated that honey in Coorg is sometimes unpalatable or injurious when a particular weed is in flower; it is also said to be occasionally acrid and injurious or poisonous in the Wynaad. It is possible there is some exaggeration in these accounts. In Germany, although bees are kept most extensively in many parts, no case of the kind has ever been recorded, so that a German poet has written, bees take the sweets and leave the bitters behind; in France, at certain seasons, in some localities the honey is somewhat bitter, but this honey is given to the bees, and the honey for sale is taken before this season.

The stings and tempers of some Indian bees are reported as very bad indeed, but my limited observations have not confirmed these statements, and such statements to be of value must be made by persons experienced in handling bees, and who know what to expect when stung. The European bees leave behind their stings and poison bladder; the pain may go away in five minutes, or may last very much longer; the swelling may be trifling or considerable, and last two or three days; the severity depends on the part stung, and how often the person has been stung before, as after a number of stings the pain and swelling become trifling, and on the state of the bee at the time, as some stings are far worse than others. The temper depends on the weather, state of honey harvest, &c. I find *A. Indica* fairly good tempered and easily handled, but its sting on my person is somewhat more severe than the sting of the Italian bee; this may arise from the fact that I am more inoculated with the Italian bee's poison. *A. Indica* is much smaller than *A. Ligustica*. Mr. Rita, who kept Indian bees at Shillong, and Mr. Hunter of Landour, who keeps the hill bees, agree in not finding fault with the temper of the bees. In India, as an European, there are absurd superstitions connected with bees. The Burmese think a swarm settling near a house unlucky; in England it is considered lucky. Possibly there are other superstitions as gross as the English one, that if the owner of the bees dies, and bees are not informed by tapping on the hive, the bees will die. I was gravely told of a case of this kind in Essex. I found the unfortunate bees had been starved to death, but I could not convince my informant.

As usual, there are several remedies for stings. One remedy is bruised tamarind leaves boiled in water: this is said to reduce the swelling. The Khasias apply *pan* leaf, which is said to allay the pain. Those applications, particularly the latter, are too generally applied to such purposes for their specific virtues to command credence. I doubt if these remedies are likely to supersede the American one in general use, which is—"forget the sting as quickly as possible."

It does not appear that there is any prejudice against using the products of the honey-bee; honey is eaten by the natives; in some parts large quantities are consumed at wedding festivals; it is eaten with rice, with bread, and with fruit; it is used to preserve ginger and fruit; it is very widely used as medicine; for offerings to and for anointing idols. Wax is used for making wax-cloth, in ointments, by shoemakers, &c. It is commonly adulterated, so that it is difficult even in Calcutta to get wax sufficiently pure for making artificial combs for bees. It appears many attempts have been made by Europeans to cultivate indigenous bees, but these attempts have not been very successful, judging from the meagre accounts given of them; in no case have the appliances which make bee-keeping certainly profitable been applied and the hives used are either out of date or never were in general use anywhere. Several reporters seem to think the frame hive used all over Europe and America very difficult to make, and requiring great exactitude; whereas any native village carpenter could make

a hive as good for practical purposes as any sold by the hive-makers in England. A tea-chest or two beer-cases would supply the wood. The books referred to are far from the latest and best. Mr. Cowan's little book (1*s*. 6*d*.) and *Modern Bee-keeping* (6*d*.), which are the best practical works in English, are never mentioned, to say nothing of the learned works published in Germany and America, the Bee Journals, and the Bibliography of Agriculture published in Italy. The following experiments were made by Europeans:—Mr. Frend had, when writing, one hive; he had kept bees for many years on the Nilgiris, but gives no particulars of yield, hive, variety of bee, or mode of manipulating. Mr. Freeman kept a stock of bees which swarmed on his premises. The Superintendent, Government Gardens, Ootacamund, a few years ago, kept a stock for three months in a deal-wood box; he fed them with syrup, but they ungratefully absconded, leaving a few empty combs. They probably became queenless, and could not raise another queen. Miss Cockburn, of Kotagiri, Nilgiri Hills, has hived bees in wooden boxes for years: her system is simply to remove all the combs but one as soon as stored, leaving one to prevent the bees absconding. This method has the one merit of simplicity, but it is no better than the native methods, and cannot be very profitable, excepting on the old principle that robbery is all profit. Mr. Harvey, N.-W. Provinces, kept as many as 30 hives in the Chumba hills; he preferred the grotto hive, a hive made up of separate frames: this hive is very little used, and is unsuited to India, as it is a bad protection against heat, cold, and insect enemies; is expensive to make well, cannot be opened and closed without crushing the bees, and is troublesome to manipulate. Mr. Harvey did not use the extractor or comb foundation, so the honey yield must have been small; but he considers the sale of this honey would give him a clear profit of 100 per cent; possibly Mr. Harvey would have made ten times this profit with fewer very strong stocks and proper appliances. An attempt to keep a hive of Chumba bees in Mooltan failed; probably they required stimulating food to keep up their numbers; not getting this, they appear to have dwindled, and become a prey to wax-moth and other enemies of weak stocks. Mr. W. Morgan, Deputy Conservator of Forests, Madras, has experimented by using beer-casks as hives, and he proposes a hive made of clay with an appliance for supering. Mr. Morgan's proposed hive would be no better than the old English skep: with it the modern practice of bee-keeping could not be carried out, and the produce would be often nothing, as bees will not work in such supers without some inducements, and there is no arrangement for taking honey from the body of the hive. The Rev. T. Mayer, Bannu, seems to have taken the matter up, and the Punjab Government proposes obtaining model hives and appliances from England. The book used appears to be Hunter's. I would recommend Cowan's book and the German hive of Dr. Dzerzon. The English firms make expensive appliances, many of which are quite unnecessary, and most are too expensive for profitable employment.

The Government of India reviewing the Reports, concludes "that several varieties of honey-bees are found in every province of India where there is sufficient forest or jungle, and that the honey of some of the varieties is good and in considerable demand; (2) that efforts have been successfully made in the hills by Europeans to domesticate Indian bees, but that the bee culture is only practised by natives in the rudest way; (3) that it is very doubtful whether the bee could be domesticated in the plains, owing to the dearth of flowers during the three or four months preceding the rains; (4) that in Southern India persons (Mr. Stormont of Bombay and others) have given up all attempts to domesticate the most common variety of bee found there on account of its intractable nature." The Government further concludes the industry is unlikely ever to be one of great importance in India. It can only be followed in the hills where flowers abound throughout the greater part of the year, or in forests where food is equally plentiful. The Government does not see its way to taking any practical steps in the direction of improving the system of bee-culture in the hills and forests; but opportunity is to be taken of the Calcutta International Exhibition to make further inquiries in the matter. The Local Governments are invited to send specimens of honey, naming, if possible, the varieties of bee which produced them respectively. It is much to be regretted the Government resolution should discourage attempts at improved bee-culture in the plains, seeing that no real trial has been made by an experienced bee-keeper. Botanists, including Mr. King, tell me there are flowers in Lower Bengal, for example, for ten months; that only in December and January do they fail. The rains have apparently now commenced, and as to there being a dearth of flowers before the rains—that is, the swarming time, and I found my bees bringing in pollen from, I think, January to the present date—I consider the conclusion erroneous as applied to Lower Bengal. Certainly, if flowers existed all the year round, the honey-bee would not need to store food and would be economically valuable; that for four months there are no flowers is an admission which proves, not that the honey-bee cannot be profitably cultivated, but that it can be far more profitably cultivated than in Europe and America, countries having severe winters, during which there are not only no flowers, but the temperature is so low that the bees cannot breed to keep up their numbers, so that it takes two months of spring weather and judicious feeding to strengthen the bees up to profitable numbers. Herr Vogel, one of the greatest German authorities on the subject, says, "most localities in Germany are honey-poor (*honigarm*), but there is in the wide German Fatherland, indeed, no place in which bees could not be kept with some success." Honey-poor localities are defined as places where all notable honey harvest ceases with mustard flowers, and if from harvest through autumn the bees get enough for themselves and their brood the bee-keeper must be considered fortunate. A neighbourhood is generally said to be honey-poor when there is no honey harvest during autumn, and such neighbourhoods form the greatest part of

Ger[many ... kept by small farmers,]
teachers, [...]
empty hive, &c. [...] very generally [...] who pay 10 marks commonly for each
bees have to be fed up [...] the hives, &c. In England the
requiring six weeks or two [...] again in February the stocks
tality, during which there is [...] up for the winter mor-
there is no severe winter in the plains. As in India generally
dearth of flowers, the bees can be fed on the two months'
sugar, and so the breeding being maintained, the [...] and
would last ten months instead of only from May to October [...]
England, and swarms could be made artificially at almost a
time. If without any protection—artificial comb, feeding, stimulating, breeding, and other devices of the agriculturist—the bees collect stores sufficient to offer a prize worth taking, surely it is a scarcely justifiable conclusion that the plains where this occurs are unsuited to bee-culture. As to the attempts made to cultivate bees, I do not think any but most favourable conclusions can be drawn from the cases reported. The Rev. T. Mayer, Bannu, has taken the matter up, and he appears to be acquainted with the subject, but no results are given. As to the native methods, even that of Kashmir, which appears humane, as the bees are not destroyed, is probably inferior to the old English one of killing the heavy and light stocks with sulphur; for the old brood comb must harbour wax-moth and other enemies of the hive bee. As to enemies, the greatest is, I think, the wax-moth, which is very common in nests of the indigenous hive bee in the plains. I have taken nests almost destroyed by it; but this could be met by giving no more comb than the bees can cover, and contracting the hive. If these measures should not absolutely keep down the moth, then the Italian bee, if introduced and properly managed, would do so, as it has in America. As to the temper of the Indian bees, as a German bee master said to me, "bees are bees," and much nonsense is talked on this subject; there is no evidence of any value that the Indian *species of hive bee* is worse than other species, and I have evidence to the contrary as well as considerable experience, for I have performed most difficult manipulations in transferring combs to frame hives. I have three stocks of native bees now in Calcutta, and they are very mild-tempered. I handle them without smoke, veil, or gloves. Mr. Stormont, referred to in the Government resolution as having found native bees vicious, does not give information as to his mode of manipulation; and as I understand his report, he simply refers to unicomb bees, and not to the kind likely to take to a hive, *viz*., the multicomb bee, living in holes, in trees, in rock cavities, &c.

It is quite possible the multicomb bee of the plains may not be so profitable as the bee of the hills; its swarms may be lighter; it may be exceedingly prone to swarm and breed drones, &c. This remains to be proved; if hill bees are much better, then queens of hill bees or small stocks may readily be imported into the plains, and no difficulty will be found in keeping them over a very large area, independent of forest and jungle. Should these be less profitable, as I think very probable, than the European varieties, then the Italian bee could be cultivated, I believe, with success, and where mustard, legumens, fruit trees, &c., are cultivated, I believe bees would be found highly profitable.

As to attempts to introduce the European bee, these have failed from well understood causes; the late Lady Anna Gore Langton imported some bees when her brother, the Duke of Buckingham, was Governor of Madras. The experiment failed. Mr. Woodside, a Missionary, N.-W. P., imported a stock of Italian bees at his own expense, but the bees perished. An Italian exporter tells me he sent bees to India *viâ* Bombay; of the fate of these I have not heard. I imported three stocks and two spare queens, with the result that I have two fine stocks which have done very well during the hot weather in Calcutta, and they find both honey and pollen. I have not swarmed them, because the queens are so young that I cannot get any drones; I have not taken honey in any quantity, because I have fed up the bees to make them breed, as I naturally require bees, not honey—the bees being far more valuable than honey. The heat has not affected the bees injuriously; they have done remarkably well, and are a living evidence that the Italian bee can be cultivated in the plains. I find the native bee very prone to swarm, and the stocks are light; it remains to be seen if the native bee can be made as profitable as the Italian; but if not, the Italian may be cultivated. As to the unicomb bees, I do not think *Apis Florea* of economic value; *A. Dorsata* remains to be tried, as nothing is known concerning the mode of cultivating it; a long thatched open-sided hive would probably have to take the place of the usual closed hive.

As to hive and appliances to commence with, one stock in an English frame hive should be tried for profitable cultivation; probably a modification of the German hive, built of clay or straw, would be found most suitable. As to appliances, I think natives should rely rather on the centrifugal extractor, by which honey can be taken from any part of the hive without damaging the comb, than on supering, at any rate at first. I made an extractor for Mr. Hunter for about Re. 1-8; the cheapest English one is 15s. I recommend Mr. Cowan's book, costing 1s. 6d., for beginners, and I strongly dissuade anyone not thoroughly acquainted with the subject from importing foreign bees; it is not a very difficult matter to order a stock of bees from Europe, but when the *few* surviving bees reach their destination (if any survive), months of care, guided by knowledge and experience, are required to prevent their total extinction, and success is very doubtful. I would strongly recommend planters and others having land to keep bees, and anyone who has a verandah in which to place a hive, or a tree under which it could be placed, may derive much pleasure and a proportionately large profit from a hive or two, commencing with two at most. I have a few books which I lend to persons desirous of trying to keep bees, and I should have much pleasure in giving any assistance in my power to would-be bee-keepers. Mr. Hunter tells me he has eight hives in his verandah; he gets excellent

honey, and the th[ou]sands of bees going in and out ... anyone but the [s]weeper (bees object to foul od... persons sit in t[he] verandah near the hives, and ... shortly to fro. If a few [E]uropean amateurs will sh... Hunter will give will, I belie[ve] in this matter read... distribute [t]he stocks of Italia[n] ... them a fa[ir] trial in the hills.

KU[DIMARA]MAT; OR, UNPAID VILLAGE LABOUR.

[It] is satisfactory to find that legislation is at last to be attempted on this important subject. The question has been so long [ri]pe for decision that a doubt arises whether the usual evils of prolonged waiting have not supervened. So long ago as 1869, the Public Works Commission recorded among the results of their enquiries—(1) "That customary labour has not been afforded to the extent necessary or formerly prevailing; (2) that the difficulty of enforcing customary labour has increased; and (3) that customary labour should be enforced by enactment." Fourteen years have passed, and yet we believe that no Bill on this subject has been introduced into the Legislative Council till now. The Hon. Colonel Sankey has taken heart of grace, and introduced the Bill that was published in the *Fort St. George Gazette* of the 1st May. The subject is no doubt beset with difficulties. Not the least is the plethora of doctors who have been ready and anxious to prescribe for the patient. The minor irrigation works of the country are the patient, and the unfortunate sufferer has been dying of neglect and inanition for the last twenty years, while doctors learned in administration have been discussing, if not quarrelling, over the remedies.

The Bill introduced by Colonel Sankey, in short, contains only fifteen sections. We propose to criticize its provisions in some detail. Section 1 extends the Act to the whole Presidency of Fort St. George, excepting the districts of Madras, Malabar, South Canara, and the Nilgiris, and the canals and distributaries irrigating more than one village in the Godavery and Kistna deltas. The wisdom of excluding canals that irrigate one village only is questionable. A canal affected by the law would cease to be affected by it, if now or hereafter it irrigated half-an-acre in the area of another village. It would be better to omit all reference to the deltas, for, by Section 2, the Government may exempt any district or part of a district, and any locality or work from the provisions of the Act. This power is ample for all purposes of exclusion. Section 2 lays down what work is to be performed by Kudimaramat, or unpaid labour. There is much confusion of language in the wording of many sections of the Bill, and careful revision by a lawyer or a legal draughtsman is very necessary. The word "landholder," which is used and defined in the Local Funds' Act, 1871, and which would be applicable throughout the present Bill, is nowhere made use of. In Section 2, landholders are referred to as "those who own (lands) in whole or in part." In Section 5 we have "the owner or proprietor of the land." The latter, interpreted with legal accuracy, would bear a more restricted meaning than the former, and yet both are apparently intended to bear a meaning exactly the same. Similarly in Section 3, works are described which are to be done "by those . . . . who cultivate land. . ." In Section 5 is laid down that under certain circumstances "the actual cultivator or tenant of the land" shall be bound to contribute the quota of labour. It is clear that a tenant need not necessarily "cultivate the land;" he may leave the land fallow, or he may employ cultivators under him. In this case, therefore, Section 5 extends the meaning of Section 2 as regards cultivators or tenants, just as it restricts the meaning as regards the landholder. In both sections the meaning should remain the same. The adoption of the terms "landholder" and "tenant" as used and defined in the Local Funds' Act would remove the difficulty. Section 2 defines the repairs to irrigation works to be done by unpaid labour. "(1) The filling up of gullies, ruts, and holes, *especially at the back of revetments*, &c., &c." The words we have italicized should be expunged. If the law requires the filling up of holes, &c., there is an end of the matter, and it matters not whether the holes are at the back of a revetment or in any other part of an irrigation work. To devote special care to a revetment may properly form part of an executive order, but not of a legal provision. To take a parallel case, the law provides punishment for theft generally, and all special cases are included, and it would be superfluous to say "whoever commits theft, especially of pocket handkerchiefs, shall be punished with imprisonment, &c."

Clause 2 runs as follows: "The prevention of the growth on village irrigation works of prickly pear, wild croton, young trees, and other vegetation endangering the safety or concealing the condition of the work." This is a clause capable of affording infinite legal wrangling in the Collectors' Courts. Prevention may be better than cure, but if prevention fails, is there to be no attempt to cure? Unpaid labour is to be applied to the prevention of the growth of certain vegetation, but not to the removal of the vegetation. If a young prickly-pear does appear above ground, or a shoot of wild croton, or a seedling, the law fails. Labour is to be applied to prevention, not removal: *a fortiori*, unpaid labour is not to be applied to noxious vegetation already in existence at the time the Act comes into operation. But the concluding part of the clause must in any case render the first part inoperative. No vegetation can "endanger the safety or conceal the condition of a work" until it has actually grown up to some extent, greater or less. But it is only vegetation of this special kind the growth of which is to be "prevented." The most acute legal intellect, we venture to say, would find it hopeless to clear a track through the word-tangle of this section.

... follows: "The preservation of such bushes and ... have been planted for the protection of the interior water-[sl]opes of bunds of tanks." This presumably means the appointment of watchmen, as it is mainly by keeping off cattle that bushes and grasses are preserved. But if ... more, as the law is now drafted, can be done. If the bushes and grasses are destroyed, unpaid labour is not to be employed for replanting them. But what unknown power is to step in and do this most essential work? Again, why are the interior slopes of bunds of tanks to be alone preserved? It is occasionally of much importance to plant up with grass the external slope of a bund. Why should the preservation of the grass on the internal slope of the bund be left to the villagers, and that of the external slope to, say, the Engineer or the Collector?

Clause 4—"The clearance o[f] silt from sluices, supply and distributing channels of tanks, spring cha[nnels] ... not maintained by the State, from river channels." With respect to this clause we would enquire how it is to be determined whether or not a river-channel is maintained by the State. Does it depend upon whether an allotment of State funds is made in any particular season or not? Allotments for clearing river-channels are frequently made at intervals of several years. Are such channels to be regarded as "maintained by the State" *in perpetuo*, or as sometimes maintained by the State and sometimes not? Again, can the Collector or the Engineer, either or both of them, announce that a channel is no longer to be maintained by the State, and in such case, will its care thenceforth devolve on the village community?

Clause 5—"The clearance of spaces between the upright stones of calingulahs (waste-weirs with upright stones) and the regulation of calingulahs, according to the requirements of the season." The introduction of a definition of the word calingulah into the body of a clause of the Act is obviously objectionable. There is no need to use the foreign word "calingulah" at all. It means neither more nor less than the English word "waste-weir," which should alone be used. A calingulah is not, as here defined, "a waste-weir with upright stones." There are innumerable calingulahs without upright stones. These, however, are dammed up with earth and turf to store up water in the tank, and need regulation and clearance like the rest. There is a further difficulty. Who is to define "the requirements of the season?" There is a vagueness about the phrase which does not commend it for use in a legislative enactment. For clause 5, we would substitute the following:—"5.—The clearance of waste-weirs, according to rules to be issued from time to time by the Collector." In the first two of the five clauses of section 3 "village irrigation works" and "irrigation works . . . . . to the village" are specially referred to. But in Clauses 3, 4, 5, there is no such limitation. The use of the words in the first two sections and their omission in the last three is probably accidental. All irrigation works may be said to appertain to some village or other. There appears to be no need for the words at all.

Section 4 of the Bill lays down that in any district, or part of a district, the Government may by notification require that any work not included in Section 3 shall be performed by unpaid labour, upon being satisfied that such work has been heretofore performed by unpaid labour in such district or part of a district. This provision opens up an important question, the discussion of which must be reserved for another issue.—*Madras Mail.*

AGRICULTURE.

(*From a Correspondent.*)

PARIS, May 19.

M. GUFFART, to whom reverts the honor of the discovery of the preservation of green fodder in trenches, or *silos*, and known under the name of *ensilage*, reminds all whom it may concern, that he alone, and no one else, is the real discoverer of that process, which has revolutionized French agriculture, and is in a fair way of effecting the same in several other countries. It was in 1852 that M. Guffart first commenced experiments, which he continued during eighteen years with varying success. It was, however, only from the moment when he cut or chaffed the green maize, treading it closely in the trench, and covering the mass firmly with planking, stones, &c., to exclude the air, that success became established. Austria, as well as other nations, were simultaneously at work, but Guffart arrived first at the practical solution. He won the honor well, and it is only right to wish that he may live to wear it long. M. Le Bian, of Brest, continues his crusade in favor of the cultivation of parsnips as a forage plant, where climate and soil suit, and these conditions are pretty general. The root is largely entering into the rations of horses, resulting in an economy of oats. There can be no question as to the importance of parsnips for milch cows. It is to feeding cows on them that a large part of the reputation of the Channel Islands butter is due, and the same observation applies to the best butters of Bretagne, for in the latter country, where the brands are inferior, the cause must be attributed to objectionable methods of preparation. German agriculturists devote much attention to the food and the feeding of animals. In Saxony ground-nuts cake has been employed, and also rice flour, in the feeding of milch cows. In both cases the quality of the milk and the quantity of the butter have been improved, while the cattle, relishing both provender, had a decided preference for the rice flour. At Halle, cotton seed cake has been added to the ordinary rations of milch cows and with beneficial results. Some of M. Pasteur's countrymen, and several Italian scientists, call in question that gentleman's important discoveries respecting the origin and causes of cattle plagues. That diseases are caused by animalcula, floating about us, and only waiting the favorable conditions of humidity, heat, and closeness, to propagate, and ... is a theory of which Pasteur does

not claim the paternity. Indeed, readers of Goethe's *Faust* will find the doctrine there published before Pasteur was born. But the latter claims, and fairly so, to have discovered certain infusoria called microbes existing in the blood of stock, victims of pests, which, by their marvellous fecundity, deprive the blood of the animal of its oxygen, and so induce death. Further, Pasteur not only produced these microbes artificially, causing death when they were introduced into the system, but he prepared that very virus in so harmless a form, that when employed as a vaccine, the cattle inoculated with it remained proof against attacks of the malady, while stock, unvaccinated, succumbed. What has not yet been demonstrated, is the efficacy of this inoculation for a longer period than six months certain. Experiments will in due course set this point at rest. The French Government has just given an additional proof of its appreciation of Pasteur's life-work by doubling his pension, by raising it to 25,000 francs a year.

There are many agriculturists in France more patriotic than practical. They belong to that class of short-sighted individuals who maintain that native breeds of stock can surpass the race of Durhams. Hence, the starting point of the angry discussions which rage. A few simple facts suffice to set the dispute at rest. In all the cattle shows held in France, they are the pure Durhams, or crosses, that invariably carry off the prizes. Every country in the world imports Durhams for breeding purposes, the Chinese being the latest. Where are such Durhams sought? In England of course: never in France. Again, the small farmers of this country have adopted the excellent habit of saving up till they have a sufficient sum, say 800 francs, to purchase a young Durham bull to serve their cows, and that animal is imported from the cradle of the short-horns.

The diminishing supply of good foreign tobacco has forced the French Government to consider the question of its home cultivation. For three years experiments in the south-western portions of the country have been carried on. The results have exceeded the most sanguine hopes. Last year, despite the cold wet season, the yield of tobacco was so satisfactory, that an important area of land is at present devoted to tobacco culture, soils of a sandy character being preferred, such being the kind on which the best brands of Havana are raised. Climate does not appear to be the decisive factor in tobacco culture. In the West Indies, tobacco is cultivated during the winter season, that which signifies a temperature equal to the summer heat at Bordeaux. The culture of tobacco can replace the destroyed vineyards, and another consolation has been found in the cultivation of China grass, or Ramie. The great obstacle up to the present against the latter has been the want of a machine to bark or skutch the stems, and set the fibre free, cleanly. Such is claimed at last to have been found, as a company has been organized not only to construct the machines, but to hire them out to the farmers. Further, the company in question guaranteed to supply seed and plants at reduced rates, and to take all the grass raised. In order to augment the supply of horses for the cavalry, the Minister of War has decided to place at the disposal of farmers, select breeding mares drafted from the State studs. The farmers will be allowed to employ the mares at light work, as payment for keep, but they must be covered only by stallions belonging to the Government studs, and those approved by the official Vet. The foals are to be registered at the nearest cavalry depot. If the mares after three years prove improper for reproduction, they will be taken back at the cost of the State.

M. Bonley, chief Veterinary Inspector, states that in the case of animals dead from a contagious disease, the best means to destroy the germs of the malady is to cook the remains, which can then be employed without danger for feeding pigs, dogs, &c. Care must be taken that while this diet suits during the rearing period of pigs, it is totally unfitted for fattening the animals. I think there are other reasons than the possibility of contracting the trichnine disease for keeping American pork out of the French market. In England and Germany, where such vast quantities of that pork are consumed, the inhabitants do not suffer from trichnine. The truth is that American food importations are so cheapening the necessaries of life, that farmers cannot obtain remunerative prices. Labor and other expenses, local as well as general taxation, the cost of machinery, &c., augment, and agriculture does not progress in proportion; hence, the secret of the situation. Everywhere vegetation is a fortnight late. This has told on stock-feeding, and has compelled animals to be prematurely sold, and at inferior prices. The future, however, is not gloomy. The vines and cereals promise well; forage will be less abundant. Farmers are not inclined to invest in implements. The sugar industry is declining owing to fiscal charges. On the contrary it is progressing in Germany and Austria. The French Budget of Agriculture allows a sum of 50,000 francs this year as prizes for the best cultivated small holdings.—*Madras Mail.*

FORESTRY.

NOTE ON FRENCH FORESTS BY MR. A SMYTHIES, ASSISTANT CONSERVATOR OF FORESTS.

1. *Strasburg.*—The forest of Strasburg, or the Hohwald, is situated on the eastern slopes of the Vosges mountains, in what was formerly the Department of the Lower Rhine, and it nearly surrounds the small village and watering place called Hohwald. It belonged formerly to the Commune of Strasburg, but, since the Franco-German war of 1870-71, it has been considered State property, and it is managed like other Crown forests in Germany.

2. The area of the forest is 2,116 acres; the total annual yield [illegible] cubic feet, or about 108 cubic feet per acre; the total annual revenue amounts approximately to 3,600*l.*, or about 1*l.* 12*s.* per acre, and the expenditure amounts to 300*l.* annually.

3. This is a most instructive forest to visit owing to the splendid natural reproduction of the two principal trees, and the regular young crops which have resulted from the regeneration cuttings themselves. Silver fir and beech constitute the greater proportion of the standing crops, and it is now many years since the regular method of compartments, as distinguished from the selection method, was first applied. There are some portions of the forest, however, where the young beech poles have been allowed to overtop the silver fir, and, though the latter has a wonderful faculty of shooting up and growing vigorously after many years of suppression, it is nevertheless obvious that, had the beech been cut away some years previously, the silver fir would be now much higher, more vigorous, and more uniform; in other words, the absence or neglect of *cleanings* has here most certainly resulted in a loss of production and of revenue, for the fir is far more valuable than the beech. These remarks, however, are applicable only to a small extent of forest, and in the younger seed crops the beech is being cut away in time, and the fir will be able to shoot ahead from the beginning. The necessity of cutting back the beech in a mixture of silver fir and beech is explained on pages 81 and 82 of the "Elements of Sylviculture," by G. Bagneris, London.

4. A comparison between the conditions of growth in the forest of Strasburg and in the fir forests of the North-West Himalayas is in many respects in favor of the former. The slopes are less steep, so that you can walk up and down with the greatest ease, and they are not so rocky; the soil is deep and always moist, there is a conspicuous absence of under-growth (shrubs, bushes, herbaceous plants), and seedlings are found everywhere under any crop which is sufficiently advanced to shed seed copiously. The main conditions of natural reproduction by seed are therefore different in the two countries, and this should be borne in mind whenever fellings are made in the Himalyan fir forests. A certain strip of forest near the village of Hohwald was entirely cleared by the wind some years ago; it has reseeded itself, and now bears a dense young crop of fir and beech; such a result would only be seen in the Himalayas under exceptionally favorable circumstances, and even on the limestone soil of the Jura, where brambles and other plants grow up in a thick mass as soon as they receive sufficient light, such a spot would have to be planted up.

5. There are various
private owners, in the
valuable returns as hop [illegible]
Schlestadt are well worth visiting, and Wasselonne is said to be as good a forest centre as can be found throughout the Vosges.

6. *Gérardmer.*—Gérardmer, in the Department of the Vosges, may be reached from Epinal by rail, or from Munster by diligence. The State forest, surrounding the fashionable watering-place of Gérardmer, contains 11,472 acres and is divided into eight working circles, of which six are treated by the regular method, while two are worked on the selection method owing to their being at a considerable altitude near the limit of forest vegetation. The rock is granite, and the altitude varies from 2,000 to 3,800 feet above sea-level.

7. The average composition of the forest is as follows:—Silver fir, 40 per cent.; beech, 30; spruce fir, 20; other kinds, 10. Here as elsewhere, the two firs are the important species, and command the highest prices.

8. The average annual yield for the whole forest is not more than 50 cubic feet per acre, and the revenue for 1882 amounted to 7,448*l.*, or about 12*s.* 9*d.* per acre. Some of the working circles, however, show slightly better results than this; for instance, the eighth working circle, called *la Grande Montagne*, has an area of 1,868 acres. The annual yield of regeneration cuttings in the first block is based on volume, and it has been fixed at 84,768 cubic feet or about 45 cubic feet per acre. In this amount are included all windfalls and dead trees of three feet girth and over, and all trees of four feet girth and over removed in thinnings, selection fellings, &c., in the remaining blocks which have not yet reached their turn for reproduction. This leaves a small amount for thinning the smaller poles, windfalls, and dead trees under three feet girth throughout the working circle, but it cannot be estimated at more than 10 cubic feet per acre, making the total annual yield 55 cubic feet per acre. The revenue from this working circle for 1882 amounted to 1,367*l.*, or about 14*s.* 8*d.* per acre. The working circle of *la Grande Montagne* is well worth visiting owing to the regular distribution of age classes on the ground and favourable reproduction, but the yield and the revenue (if the figures given above, which were furnished by the local forest officer, fairly represent the average of a series of years) are remarkably small, and in this respect this forest compares unfavorably with other forests in the Vosges. The rotation on which this circle is worked is 144 years, divided into four periods of 36 years each, to each of which a block of an average area of 467 acres has been assigned. There are four Government saw mills in the locality, besides numerous private ones, and as a rule all the firs are cut up into planks on the spot. The total length of forest roads is about 42 miles. Gérardmer is well known to all forest officers who have passed through the school at Nancy, as every year the students are taken there to undergo a course of triangulation, and to be instructed in the working of saw mills, of which there are many kinds within the vicinity.

9. *Pontarlier.*—The communal forest of Pontarlier is situated near the town of that name on what is called the second plateau of the Jura Mountains consequently on the Jurassic limestone, and at an average altitude of 2,500 feet above the sea level. The first working circle has an area of 574 acres, and the average annual yield is about 79 cubic feet per acre, including thinnings and selection fellings. These limestone soils are rich, and there

is a great variety of undershrubs in this forest, including three species of *lonicera* and a herbaceous elder. If too much light is admitted on to the ground before the crop of young seedlings is thoroughly established, a dense crop of brambles springs up, chokes pre-existing seedlings, and renders natural reproduction slow and uncertain, if not altogether impossible. The third block of this working circle is chiefly remarkable for a regular and complete pole crop of silver fir sixty years old; the leafy canopy is complete, and there is scarcely any herbaceous vegetation on the ground. This portion of the forest is the more interesting as the reproduction cuttings which resulted in the present excellent crop were made in 1820 by M. Lorentz, one of the founders of modern French sylviculture and now Director-General of the Forest Administration.

10. One circle is worked on the selection method on account of the steepness of the slope, thus resembling in some of its features a Himalayan forest.

11. *La Fuvelle.*—This forest derives it name from *fue*, an old word for *epicea*, the spruce fir. It is situated on the third, or highest, plateau of the Jura mountains, at a mean altitude of 3,280 feet above sea level. The total area is 366 acres, and the forest is worked on a rotation of 140 years, which is divided into seven periods of 20 years each; there are consequently seven blocks containing on an average 52 acres each. The second period commenced in 1878, so it is in the second block that regeneration cuttings are now being made. In the first block, which was regenerated from 1858 to 1877, thinnings have already taken place once.

12. The crop consists of spruce and silver fir in almost equal proportions, and here it is the former which is the more valuable, the spruce having a value of about 7*d.* a cubic foot standing timber, whereas the silver fir is not worth more than 5½*d.*

13. The soil is not deep, and the trees do not attain a greater length of timber than 80 feet; but for all that the forest has been so carefully organized and managed that the returns are remarkably good considering the great altitude. The average annual yield, taken from the figures for the last 25 years, amounts to 49,229 cubic feet, or about 135 cubic feet per acre; the average annual revenue during the period amounts to 928*l.*, 2*l.* or 10*s.* 8*d.* per acre; while the expenditure has not been more than 40*l.* per annum, excluding the proper share of pay of the superior officers; this would not however raise it to any considerable extent, and there remains a handsome net annual revenue to the State.

14. In the second block, where reproduction fellings are now going on, we find numerous young seedlings of the two firs in the most promising condition; many of them existed on the ground before the primary cutting was made (*advanced growth*), and are now profiting by the extra amount of light given to them; the soil is not deep, and consequently there are no brambles or brushwood to interfere with reproduction, and the thin covering of moss on the ground permits the seed to germinate with great facility. The crop is aged from 140 to 150 years, as shown by the annual rings, and the tree have a mean girth of 6 feet at a height of 5 feet above the ground.

15. The third block shows a dense crop of tall timber, with much young growth of various sizes underneath; here and there the wind has blown down some of the taller trees, but generally speaking, the forest of *la Fuvelle* seems to be singularly free from the ravages of the wind. This is not the case with all forests in the locality, as there is a forest higher up the valley, where 5,000 trees were blown down in a single day, stopping all fellings for two years, greatly interfering with the nice calculations of the annual yield, and of course seriously compromising reproduction, for it is not every forest where one may expect such a favourable issue as that mentioned under the forest of Strasburg.

16. In the fourth and fifth blocks the trees are somewhat smaller, and the sixth and seventh have been already regenerated. Selection fellings are carried out in the third, fourth, and fifth blocks. In the seventh block we find a complete and regular young crop, 80 years old, growing up under the best possible conditions, with rather more spruce than silver fir. The average height of the poles is 85 feet, and their girth 4½ feet.

17. This most instructive forest is well worth a visit, as all the details of the organization project (which for this forest was prepared by M. C. Broilliard) can be the more readily appreciated by the beginner, as there is only one working circle, and the various age classes are very fairly represented.

18. *La grande Côte.*—The neighbouring forest of *La grande Côte* is situated on the other side of the valley at about the same altitude. It contains an area of 947 acres, and is worked on a rotation of 150 years; it forms one working circle, and is divided into five blocks, with five periods of 30 years each. The first period commenced in 1858, and is consequently approaching its term. The conditions of growth are much the same as in *la Fuvelle.*

19. The average annual yield, from the returns of the last 25 years, amounted to 104,636 cubic feet, or about 110 cubic feet per acre, and the gross annual revenue has amounted on an average to 1,970*l.*, or about 2*l.* 1*s.* 7*d.* per acre, while the expenditure—omitting as before the pay of the superior officers—has not exceeded 81*l.* per annum.

20. *Levier.*—The forest of Levier is situated on the gentle slopes which descend from the second plateau of the Jura to the first plateau. It is distant about 16 miles from Pontarliar, and is in the conservatorship of Besançon and the department of the Doubs. The mean altitude may be put down at 2,500 feet above sea level.

21. The geological formation is the Jurassic lime-tone.

22. The area of the forest is 6,784 acres, and it is divided into eight working circles, and the transitional rotations adopted in them vary from 80 to 120 years; but when the forest has been finally recognized as high forest, worked by the regular method of thinnings, the rotation will be uniform and fixed at 160 years. There will also be a smaller number of working circles.

23. As an instance of the present organization of the forest, we may take the second working circle called *Grand Jura Ouest.* The area is 622 acres, the rotation is 100 years, and there are five blocks, with five periods of 20 years each. The annual yield of the principal cuttings is drawn from the second block, together with some old trees remaining in the first block, and it has been fixed at 44,933 cubic feet. In the third and fourth blocks selection fellings are made, and they extend over one-fourth of the area every year; in the first and fifth blocks improvement cuttings are made over about one-tenth of the area every year, so that any one part is re-visited every *four* years in the first and every *ten* years in the second case.

24. The following figures have been compiled from an elaborate return furnished through the kindness of M. Carlot, the Inspector of Forests at Pontarlier, and, as they embrace a period of two-and-twenty years, they may be relied upon as correct and adapted to show the true financial state of one of the best State forests in France.

Average of the 22 years, 1861 to 1882, inclusive.

Annual yield of all fellings	1,125,186 cubic feet.
	£
Value of this yield (gross revenue)	22,252
Expenditure (not including a share of the pay of superior officers)	468

Reducing this to the acre, we find that the annual yield amounts to 166 cubic feet, and the gross revenue to 3*l.* 6*s.* 1*d.*, a result probably unqualled in any other forest in France. If we allow a large margin for the proper share of the pay of superior officers, we shall find that the average *net* annual income to the State amounts to *three guineas an acre.*

25. The crop consists almost entirely of silver fir, which, in this forest, attains its finest dimensions as the following measurements will show:—One tree was 13 feet in girth, at 5 feet from the ground, and was 155 feet long, taking in all that could be sawn. Another tree, blown down by the wind, measured 146 feet long, and, roughly squared at the base, girthed 10 feet. Many trees standing had a girth of 10 feet and over, and as a rule logs are drawn out of the forest 80 to 120 feet long. There are large steam saw mills in the vicinity of the forest, and these logs are drawn out by bullocks in their entirety, so that they can be sawn up to any required scantling. In the Vosges the logs are scarcely ever more than 13 feet long, as that is the usual length of the planks required for the market. There is thus in the Vosges forests very little damage done to the young crops, whereas in the forest of Levier the injury caused to young saplings and seedlings is enormous. It is especially at corners and turns in the road that the chief mischief is done, for as the log sweeps round, it smashes and destroys all the young trees with which it comes in contact.

26. The wind is the most dangerous element the forest officer has to contend with on this exposed plateau of the Juras. In the eighth working circle a large space, containing over 200 trees, was cleared by the wind in 1880, and the soil is now covered with turf and brambles. The crop was a dense high forest, about 170 years old. There were very few seedlings underneath, and now the whole area will have to be planted up with some difficulty, as silver fir does not come up well in the open. Even in conducting the regular cuttings great prudence has to be exercised, as, if too much light is admitted, the rich soil gives birth to a dense mass of brambles and herbs, which greatly impede the growth of seedlings if they do not entirely prevent it. Similar results, only on an exaggerated scale, may be seen in the silver fir forests of the North-West Himalaya, where, even under the densest canopy of mature trees, the undergrowth of herbaceous plants is so thick that seedlings establish themselves with difficulty, and the evil is made worse when more light is admitted.

27. Forest officers on leave from India should be recommended to pay a visit to the forest of Levier, as there is much to be learnt in every way from a careful inspection of this splendid forest; and if ever a Forest School is created in England, and the students are taken abroad to study continental methods of forestry, they would do well to direct their steps to Pontarlier and make themselves thoroughly acquainted with the silver fir forests of the second plateau of the Jura mountains.

28. *La Joux.*—The forest of *La Joux* touches the forest of Levier on the south, and in reality forms one continuous forest, only it is in a different department and in a different conservatorship. Its area is 6,543 acres, and it has a mean altitude of 2,625 feet above sea level. The forest is divided into five working circles as follows:—

Name.	Area in Acres.	Rotation Years.	Annual Yield. Total.	Annual Yield. Per Acre.	Remarks.
			Cubic Feet.	Cubic Feet.	
Northern ...	1,589	100	120,688	76	The annual yield is that of the regeneration cuttings alone in the first and fifth block.
North-Eastern	809	160	78,797	88	
Eastern ...	1,297	140	143,470	116	
Southern ...	1,213	140	109,313	90	
Western ...	1,603	140	142,198	89	
Total ...	6,543	...	594,466	90·8	

29. To this annual yield of 91 cubic feet from the regeneration cuttings in the first and fifth blocks, we must add that which

results from thinnings and selection fellings in the other three blocks. This may be estimated at 45 cubic feet, and we thus obtain a total annual yield of 136 cubic feet per acre.

30. The gross total revenue is now 16,000*l.*, or about 2*l.* 8*s.* 11*d.* per acre. It was formerly as high as 20,000*l.*, but the price of wood has gone down. The expenditure may be estimated at 800*l.*, or about 2*s.* 6*d.* an acre, leaving a handsome net income to the State, though it does not come up to the forest of Levier. The conditions of climate, aspect, growth, export, &c., are very much the same in the two forests, and it is not easy to understand why there should be so much difference in the revenue and in the yield.

31. *La Fresse.*—The forest of *La Fresse* adjoins the forest of La Joux with an area of 2,820 acres. The crop consists principally of silver fir, but this tree does not attain the same dimensions here as in the forest of Levier, and the yield and the revenue are much less.

32. *Chamonix.*—The communal forest of Chamonix is situated both sides of the valley and chiefly between that place and Argentière. The area is 2,750 acres. It is composed almost entirely of spruce, fir, and larch, and is worked by the selection method. Any other method of treatment would be here quite out of the question. The high parts of the forest are at the limit of tree vegetation, and the extreme rigour of the climate, combined with steep and rocky slopes, render reproduction difficult and uncertain; seedlings of larch and spruce, however, are not wanting wherever the light and the soil are suitable. There are but few large trees remaining in the forest at the present time, and the spruce seldom attains a larger girth than 6 feet, while the larch is found 8 or 9 feet in girth.

33. The annual yield was estimated at 35,300 cubic feet, or about 13 cubic feet per acre, but these figures must be accepted with some reserve; still there is no doubt that the yield of forests so high up cannot be compared with that of forests lower down, and on more fertile soils. It may be as well to state that the revenue of this forest cannot be given, as the timber cut annually is divided among the inhabitants of Chamonix, who either sell their share or use it up for their own requirements. The value of the cubic foot of spruce standing in the forest is about three-pence, while that of the larch is almost double.

FOREST PROGRESS REPORT FOR BENGAL, 1881-82.

THE area of reserved forests in Bengal was, at the close of the year, 4,236 square miles, or an increase of 825 square miles during the year under review, and the Conservator is to be congratulated on the fact, that in his own words, he has very nearly come to an end of the first great work to be done by a Forest Department, on its institution, namely, the demarcation and settlement of the forest areas actually available. The Sengallia range near Darjeeling, extending over 60 square miles, was demarcated by Mr. Gamble, who thus describes it: "These forests contain, with the exception of a small area of *Pinus longifolia* forests in the valley of the Great-Rangit, the only areas covered with the coniferous trees in Bengal Forest Circle. The conifers which are found in them are of four species, the silver fir (*Abies Webbiana*), the Indian hemlock spruce (*A. dumosa*) the blue juniper (*Juniperus recurva*), and the yew (*Taxus baccata*) The silver fir forms large forests, almost pure, on the slopes of Sandukpho and Suburkaffi, from an elevation of 12,000 feet down to 10,000 feet, at which point it is replaced by the hemlock spruce, which is also gregarious, but to a less extent than the silver fir, being often mixed with rhododendrons, birches, and other trees. The blue juniper is only found occasionally in single specimens, but is valuable on account of its leaves, which are much used to burn in the Buddhist temples. The yew, which occurs at the lowest elevation of the four, is not uncommon on Tonglu, where very large trees, reaching even 20 feet in girth, are ocasionally met with.

"The common oak in these forests is the *Quercus pachyphylla*, which is frequent and of large size and straight growth. Both red and white magnolia (Camp) are also common."

We are glad to see that steps are likely to be taken shortly for placing the private forests in the Chota Nagpore Division, with the approval of the owners, under systematic management, and we would recommend Conservators in other circles, where private forests are numerous, to consider whether similar steps cannot be taken in their respective provinces.

Referring to the zemindari forests in the Hazaribagh district, the Conservator states that it is a noticeable fact that almost throughout Hazaribagh, the villagers, while grazing over or cutting the said forest, have the habit of usually leaving some small area covered with sal poles sufficient to supply them with building materials, and that the resources of these village reserves are carefully husbanded, and cutting only allowed under self-imposed conditions. This practice shows that the people are quite alive to the necessity for careful management, and that they will be quite capable of understanding the objects with which an attempt to introduce forest conservancy is made.

On Mr. Gamble's proposals for the formation of village forests, the Local Government makes the following favourable comments:—

"The importance of this question and its bearing on the economic condition of large portions of these provinces, cannot be exaggerated. In addition to the beneficial climatic effects which groves and forests are now admitted to produce, it is evident that the provision in many districts of a cheap and convenient supply of firewood means the ultilization for agricultural purposes of the vast quantities of manure which are now used for fuel. From the employment of manure for agricultural purposes, an improvement in the harvest yield might be confidently expected, not to speak of the introduction of more valuable staples. We have now in Bengal reserved forests for the supply of large timber, but in situations more or less remote, where population is scanty and communications bad; we have protected forests managed by Government in the interests of the public; but we have none of the third class of forests contemplated by the Act—village forests for the supply of fuel only. It is time that some beginning should be made to supply the want, and the Lieutenant-Governor will be glad to receive from the Forest Department or from local officers some proposals on the point."

The protection from fire of 970 square miles were attempted, but the season was not a favourable one, and 7 per cent of the area was burnt. A remark is made in the review of the Government of India to the effect that the data given in form No. 51 differ widely from those given in the body of the report, and that in future years from No. 51 should show only the areas regarding which special measures have been taken to keep out fires. It is most important that this should be observed, as if in one province evergreen forests are shown, and in the next excluded, no fair comparison can be made of the cost of protection per acre. That fires in Bengal can be very disastrous, is unquestionable, as it appears that the fire which occurred in compartment No. 9 of the Runbul block, Darjeeling Division, killed nearly every tree in it, and left the ground bare with tall dry stems standing up in it. These are now being cut as fuel, and the compartment is being planted up. As a proof of the good effected by fire protection, we quote para. 114 of the report:

"In this place it is well to refer to the very marked improvement which the forests of the division (Kurseong), have made in the last ten years.

"The Officiating Inspector General visited the division in the Conservator's company, and most especially in the sal producing blocks of the Dulka jhar, the Sivoke forest, the Mahanadi forest, and the Marjha forest was the improvement noticed. Sal forests, that a few years back consisted of small thin poles with much grass, are now densely stocked with tall young trees, and the grass is rapidly disappearing.

"Savannahs that formerly showed scarcely a tree are filling up and no longer deserve that name. Much of this is doubtless due to fire protection, but still more to general protection from cuttings, and especially to demarcation and good boundaries."

There are 1,215 acres of regular plantations which do not include such "cultural" operations as supplying blanks in natural forests, or re-stocking cleared areas, and it would be as well for all Forest Circles to adhere to this rule as far as possible.

The largest plantation is in Bamunpokri in the Kurseong Division, and it is reported to be doing well.

The Sunderbun is the great revenue-producing division of the Circle, with a revenue of over 3 lakhs for the year under review, whilst the majority of the other divisions show small deficits, which it is anticipated will in a few years be changed into surpluses.

The revenue of the circle is derived from the following sources:

		Rs.
Timber	... ...	3,31,000
Fuel	... ...	1,60,000
Bamboo and other minor produce	...	1,00,000
Miscellaneous	... ...	43,000
Total Rs.	...	6,34,000

More than a lakh of rupees was received on *Sundri* wood (*Heritiera littoralis*).

In the "Manual of Indian Timbers," a new and excellent work completed by Mr. Gamble in the year we are reviewing, we find the qualities of this timber, and the character of the forest it forms thus described: "Sundri wood is durable; it is heavy and does not float, and is extremely tough. It is used for a great variety of purposes, such as beams, buggy shafts, planking, posts, furniture, firewood; but chiefly in boat-building, for which purpose it is very extensively used in Calcutta, and particularly in the Government Dockyard at Kidderpore. It is the chief timber of Sunderbun forests. Its reproduction is most favourable.

"On all lands flooded by ordinary flood-tide, a new growth of jungle springs up immediately, but on land ordinarily above high-water mark it only establishes itself by slow degrees. It soon spreads itself on newly-formed islands on the sea edge of the forests. The roots of the Sundri do not penetrate deep into the ground, but spread laterally 2 to 3 feet below the surface, sending out perpendicular tough shoots, which stand from 3 to 15 inches in height all round the parent stem, and when there are many trees close together, walking through a Sundri forest is very much like finding one's way among a fine growth of inverted tent pegs."

The Sunderbuns, besides timber, furnishes a considerable quantity of minor forest produce, and nearly half a lakh of revenue is obtained from galpatta (leaves of (*phœnix paludosa*) used for making ropes and for thatching. Another curious item of revenue in this division is the Rs. 2,000 odd received for shells.

Tigers appear to be increasing in these swampy forests, and no less than 161 wood-cutters were carried off by man-eaters during the year, or more by 76 than the number for the preceding years.—*Indian Forester.*

THE GARDEN.

THE GARDEN BALSAM.

THIS favourite annual is one of the best we have for brightening up our gardens in the rains, and during the flowerless months in the beginning of the cold season. The wild species, *Impatiens Balsamina*, from which our garden varieties have sprung, is a native of India, and is principally found growing in damp, shady places in the lower Himalayan valleys. The wild plant has a beauty of its own, but from a florist's point of view it is not to be compared with the variously colored, double-flowering cultivated varieties. It is grown in most of the European and Native gardens throughout the country, but unless the plants have been raised from imported seeds, the varieties met with are not far removed from the wild species. It is possible to raise plants from Indian grown seed with flowers little inferior to those of the best Camellia and Carnation flowered varieties of European nurserymen's catalogues, and as raising one's own seed is a pleasing and profitable occupation, I shall, further on, describe the most certain method of securing a strain of good acclimatized balsams. The coarse weedy strains will exist without any care or trouble, but in order to have well grown plants of good varieties in flower from July until November, a little attention has to be paid in selecting the dates for sowing, and also to their treatment during the progress of growth.

The first sowing should be made in the beginning of June, and continued every fortnight until the beginning of September. The seed pots should be kept under the shade of a tree, or covered by mats or any suitable shading material until the seeds germinate. As soon as they have germinated, shade should be gradually withdrawn until the seedlings are able to stand full exposure to the sun. When the seedlings are two or three inches high, they should be potted singly into small pots, and again shaded for a day or two until they have made fresh roots. In the course of ten days or a fortnight they will be ready for a shift into a larger sized pot, and the same process should be continued until the flower buds begin to appear. In order to have good specimen plants, three shifts should be given during their progress of growth, but if time cannot be spared, and if the proper sizes of flower pots are not to be had, only two shifts need be given. It is a good plan to see that the *mali* does not neglect to shift them as soon as ready, and that he uses the proper sized pot. As a rule, when left to his own devices, he will transplant them from the seed pot into one of the largest he can lay hold of. The result of his treatment is tall weedy plants or total loss from sourness of soil and damp. The gradual transplantation from a small-sized pot into a larger is a very important matter, and should never be neglected when specimen plants are desired. The soil should be light and rich, and the pots thoroughly drained. I find the following to be a very suitable mixture of soil, *viz.*, one part loam, one part old cow or stable manure, one part leaf mould, and one part sharp river sand. Water liberally, but take care that the soil in the pots never becomes sour owing to defective drainage.

In order to save seeds from the Camellia and Carnation flowered varieties sent out to this country by European nurserymen, the sowings made from the beginning to the middle of July, should be especially looked after. Sowings made previous to that time generally fail to produce seed, owing to damp, and those made later fail owing to cold. When the plants are densely branched, thin out the lateral shoots, so as to allow of all those remaining to stand clear of each other. If the strain is a good one, the flowers will be very double, hence many may fail to produce seed, and those that do, only produce it in small quantities. As they seldom all fail to produce a few seed pods in October and November, a few ripe seeds are generally obtainable. These should be carefully stored, and kept until the following July, and sown between the beginning and middle of that month. The flowers from the acclimatized seed of the first season are invariably of poor quality. Many are single and semi-double, and a few double, but inferior to the flowers of the previous season, grown from imported seed. The best double flowering plants should be selected as seed-bearing stock, and kept as far as possible from the plants with single and semi-double flowers. If selection and isolation is carefully attended to, it will be found that the proportion of good double flowers will increase yearly, and in the fourth season out of hundreds of plants scarcely any single or semi-double flowers will be met with. The strain of acclimatized balsams you thus secure will seed freely, and possess flowers nearly of equal merit to those of the best imported varieties. They are also much hardier and not so subject to damp off during periods of excessive rainfall.

-*Indian Forester.*] N. W.

MINERALOGY.

On Lateritic and other Manganese Ore occurring at Gosulpore, Jubbulpore District, by F. R. MALLET, F.G.S., Geological Survey of India.

IN a previous volume of the Records (1) some account is given of the manganese ore at Gosulpore, which was visited by the Superintendent of the Geological Survey in 1879. The sections then available for examination were very poor indeed, but, judging from what could be seen, Mr. Medlicott thought that a large supply of the ore could probably be depended on. The following year a shaft was sunk with a view of testing the richness of the deposit. When this had reached a depth of 20 feet, the engineer in charge reported "that all trace of the ore was lost at a depth of nine feet from the surface, at which depth a yellow subsoil, resembling ochre, was entered: that about 1½ cubic feet of ore were obtained, and even this small quantity of rather an inferior quality; that in consequence I recommended and discontinued operations." As this discouraging result was at variance with the hope previously entertained of a considerable supply, I was directed to take the opportunity, while in the neighbourhood recently, of visiting the locality and seeing how the discrepancy was to be explained.

(1) Vol. XII, p. 99.

The shaft is dug on the site of the pre-existing holes examined by Mr. Medlicott, from which the ore had been extracted for use in glass-making at Murwara and elsewhere. The section comprises—

	Feet.
a. Laterite	4 to 5
b. Manganese ore	2 ,, 3
c. Laterite containing some nodules of manganese ore, about	6
d. Distintegrated quartz schist dipping at a high angle (to bottom of shaft)	7

The manganese ore *b*, which, as mentioned in the previous notice (2) is pyrolusite mixed with some psilomelane, occurs in the form of irregular spongy nodules varying in size from a fraction of an inch to several inches diameter, and averaging perhaps half an inch to 1 or 2 inches. These seem to constitute an irregular layer, which is 2 feet thick, or rather more, at the shaft. It is exposed in two or three other places within a length of 20 feet. The level varies somewhat even in this short distance, and, as pointed out by Mr. Medlicott, the ore found in the village well, 120 yards to the east, is at a lower level than that at the shaft. This difference is, I think, to be ascribed to the laterite (including the ore) having been deposited on an irregularly denuded floor of Bijawar rocks.

There is little or no laterite of the ordinary (ferruginous) type included in the manganese stratum, and the separation between this stratum and the laterite above is tolerably well defined; that between the manganese and the laterite below is not so well marked, the laterite containing occasional nodules of pyrolusite through it. The laterite above and below the ore looks somewhat like detrital variety, but experience elsewhere has led me to believe that the rock laterite (3) has a tendency to disintegrate into a mass of irregular nodular fragments, which bear a very close resemblance to the detrital form. Taking into account that no distinctly foreign matter is visible in the rock in question; that undoubted rock laterite occurs close by; and that the manganese ore is pyrolusite, not psilomelane (a point to which I shall allude again), I do not think there can be any reasonable doubt that the laterite, inclusive of tin ore, is rock laterite not detrital. Such is the view which Mr. Medlicott also took: "This laterite is of the older type; at least in the exposed sections I could not detect any palpable *debris*, which generally characterises the secondary or detrital laterite. It is therefore presumable that the lumps of ore are innate, and that the manganese is an integral component of the laterite in this position."(4)

With reference to the original source from which the manganese was derived, it is, I think, scarcely open to doubt that it is to be sought in the strong band of manganiferous micaceous iron which outcrops along the southern side of the Lora range and again at Gosulpore (5). But, as I said in the preceding paper, the manganese in this ore occurs mainly, if not entirely, in the form of psilomelane, while manganese of the laterite is mainly pyrolusite. The latter, therefore, cannot be the result of mere mechanical degradation and transport, unless it be supposed that the nodules in which the ore occurs are pebbles, originally of one mineral which has subsequently been changed into another. This mode of origin is rendered very unlikely by the absence of any other recognisable debris in the manganese stratum.

If the latter be not a mechanical deposit, it must be a mechanical one. Carbonate of manganese being, like carbonate of iron, soluble in water holding carbonic acid in solution, the former metal is capable of being leached out and re-deposited in the same, or nearly the same, way as the latter (6). During the deposition of the main stratum of manganese ore, the water appears to have held little but manganous carbonate in solution, while at the time the laterite below was formed, ferrous carbonate was the chief substance dissolved, but with some manganous salt, the manganese subsequently separating itself into nodules by segregatory action. Specimens may be obtained consisting in part of ordinary laterite, and partly of manganese oxide.

The occurrence of this manganese laterite, interbedded with ordinary ferruginous laterite, furnishes, I think, strong evidence in favour of the view as to the origin of the latter which I have advocated in a former paper (7) namely, that laterite is (in as far as the iron is concerned) a chemical deposit due to the leaching out and re-deposition of iron through the agency of decaying

(2) *Ibid*, p. 103.

(3) By 'rock laterite' I mean the first form of laterite mentioned on page 117. The term is no doubt open to criticism, but is convenient and serves to avoid circumlocution.

(4) Vol. XII, page 99.
(5) Page 102.
(6) *Vide* Vol. XIV, page 145.
(7) *Ibid*, page 139.

[illegible] and the carbonic acid produced by its decomposition. I of course am speaking of the first only of the three forms of laterite which I believe are now generally recognised, *viz.*—

1st.—Laterite due to deposition, and excluding the *3rd* form.
2nd.—Laterite due to the alteration of other rocks *in situ* (3).
3rd.—Detrital laterite due to the denudation and re-deposition of the *1st* or *2nd* form.

With reference to the amount of manganese ore obtainable, it is not easy to form any decided opinion. I think, however, that there is a fair chance of the layer being somewhat extensive, although very likely subject to much irregularity in level and the amount of overburden covering it, and perhaps, in thickness also. When there is a demand for the mineral, the bed might be followed from the present diggings, and the superincumbent laterite utilised for road metal on the Deccan road which passes close by.

It will have been seen that the reason why so little ore was obtained from the shaft was that the latter passes through the manganese stratum into quartz schist below it. The shaft, indeed, merely exposed the thickness of the bed, but proved nothing as to its lateral extension.

In the preceding paper I have pointed out that a considerable quantity of psilomelane occurs with the manganiferous micaceous iron at Gosulpore. If the latter were worked in connection with iron-making, the psilomelane would be raised at the same time, and available as an ore of manganese. On assay it yielded 83·20 per cent of available peroxide: or about the same amount as the lateritic pyrolusite. From both sources combined, it may be reasonably hoped that a considerable supply of ore will be procurable when there is a demand for it.

Further Notes on the Umaria Coal-field (South Rewah Gondwana Basin); by Theo. W. H. Hughes, A.R.S.M., F.G.S., Geological Survey of India.

In my notes of last year on the Umaria coal-field were embodied the general results inferable from the evidence afforded by the preliminary experiments carried out under the management of the Rewah State: that coaly matter occurred in abundance; that it lay at a shallow depth from the surface over a proved area of 1½ square miles; that it thickened to the deep; that the gradient was low and advantageous for working; and that the quality of the coal at the outcrop was encouraging.

The promise was a fair one, and from the exceptionally commanding geographical position of the field, it required small advocacy to show that if the expectations based on the introductory enquiries were confirmed, a splendid reserve of coal had been established. I am happy to say that Captain Barr, the Political Agent of Rewah, has keenly appreciated the exigencies of the case, and his further sanction has been obtained for carrying out such trials as shall set at rest any apprehensions that prudence may give rise to.

I confess that I have little or no misgiving as to the worth of the Umaria and the adjacent Johilla fields, and I have belief enough in my opinion to give it expression. But I admit the necessity of verification; and, in view of the important issues dependent upon the true practical estimate of these fields, I strongly commend the course that had been suggested of reducing to its narrowest limits the margin of uncertainty regarding the nature, quality, and permanency of their seams.

To achieve this object it was determined that the coal should be approached under the ordinary conditions of approved mining. There were two plans open for adoption, either to drive an incline from the outcrop, or to sink a shaft to the seam. The second method was preferred, as being in every sense more workman-like, and as affording more scope for efficiently dealing with an influx of water; and on the 11th March 1883, a pit of 10 feet internal diameter was commenced under the charge of Mr. Thomas Forster, M.E.

The position of the pit is near No. 8 bore-hole, where Mr. Stewart struck coal at 93 feet from the surface and recorded the thickness of the seam as 10 feet. I had a strong wish to go further to the deep towards No. 9 bore-hole, but I was deterred by the dread of water, and the possibly heavy outlay that would have to be incurred for pumping machinery.

In an untried field it is always impossible to gauge the water difficulty, and I selected the spot for the trial shaft where I anticipated the least amount of inconvenience on this score. The choice has been up to the present justified by the results, for though the shaft is 40 feet deep, one workman occasionally bailing suffices to keep it dry. Should the pleasant expectation that this fact gives rise to be strengthened by further experience, I would certainly recommend another pit near No. 9 bore-hole being put down. In the future development of the field, it would act as a ventilation channel; and in the initiatory stage it would yield another point where the quality of the coal might be judged.

According to the journals of last year, two seams measuring respectively 10 feet and 6 feet were passed through in No. 9 boring, and I remember that the coal brought up in the sludger was very clean and bright.—*Records of the Geological Survey of India.*

(3) Some examples of this form are noticed in the preceding paper, pages 97, 98.

TOBACCO.

CULTIVATION AND MANUFACTURE OF TOBACCO.

Memorandum on Tobacco Cultivation and Curing at Gazipur in contrast with the French system described by Kumar Gozendra Narayan, Jr., of Kuch Behar, in his Memorandum, page 19 of his Report on the Cultivation and Manufacture of Tobacco in France, 1881.

Shelter for field.—The tobacco fields are usually sheltered from the hot west winds by a high crop on that side, or, in the absence of this, by sowing a line of castor-oil plants or any other fast and high-growing crop. The cultivation commences in July. In France in October.

Rotation of crops.—We follow the American system, and tobacco is grown on the same land only once, or on rich land twice, in three years. The land usually lies fallow the third year, or should do, and in America a crop of oats is often sown, which crop is ploughed into the land just as the ears commence to form. In france tobacco is grown on the same land only once in in from five to seven years.

Manure.—The manure at Gazipur and Poosa consists principally of cowdung and vegetable manure, such as leaves, indigo *seet*, &c.; at Gazipur a good deal of night-soil and poppy trash. The land is manured yearly.

Soil.—Lands suitable for sugarcane and poppy are selected as being the richest. The land is ploughed from commencement of rains to time of planting, or earlier if feasible.

Seed-bed.—A piece of good high land is selected, well ploughed, cleaned and manured with good old manure (low ground would swamp). The ground, when soil has become well pulverised, is now marked off into beds four feet broad and running the whole length of the ground. The bed is slightly raised in the centre as a protection against heavy rain. A small ditch is cut between the beds to drain off the rain. Tatties made of straw or *arhar* twigs are put over the beds, and are raised three feet from the ground. The seed is sown in July, and the second sowing is made in August in case of accidents. The seed is sown at a different season to the French season, and differs in soil, and in not having a stony hard under-surface which would not drain off well.

Sowing in seed-beds.—Two table-spoonfuls of seed are sown over 100 square feet of seed-beds. It is sown mixed with ashes.

It is not left to germinate before being sown as in France (this plan has not yet been tried). It is sown by a man who stands in the ditch running between the seed-beds. After the seed is sown, the bed is beaten down gently with a plank, or the naked feet of coolies. The seed germinates in eight days. The land is kept clean from weeds. The tatties are kept on for at least a fortnight. They are left of gradually, that is to say, they are first taken off for a few hours daily, in the morning and evening and at night, till the young plants get accustomed to the sun. They are a protection to the plants from the sun and also from heavy rain which often washes out the earth from the roots of unprotected seedlings. This is also done in France.

The tatties must not be left on until the young plants are transplanted, or else the plants will be weak and unable to bear the sun.

Transplanting.—The land having been well ploughed and cleaned from the middle of June to the middle of August, is smoothed over with a *henga* (harrow), and the young plants being now large enough, they are transplanted when the leaves are not quite the size of a rupee. A cloudy or rainy afternoon is selected for the planting (the afternoon is better than the morning, as it gives the plants the whole night in which to take hold).

The field is either marked out beforehand, by means of a long rope laid on the field, along and on which a few coolies are made to walk, and which leaves a clearly-defined line marked on the field; these lines are made first down the field and then across, each line being the same distance apart, or else a lighter rope marked with knots is thus laid on the field at the time of planting, and a plant is put in opposite each knot. It is very necessary for facilitating the after working of the tobacco that the plants should be equidistant from each other. In rich land the plants are put three feet apart. In poorer soils they are only two feet and two and-a-half feet apart. No plants whose stems have become at all hard should be planted; they will certainly be stunted. Grubs should be looked for in the roots and stems, and all affected plants thrown away. If the ground is hard and clayey, it is desirable to stir the earth with a *kherpee* a little round the young plants three or four days after the planting.

Hoeing and earthing up.—The land is usually hoed about 10 days after planting. When the plants are from a foot to 1½ feet high, the earth is thrown up round the roots of each plant. This

is the same process apparently as that described as ridging by Kumar Gozendra Narayan, Jr., in his memorandum.

Irrigation.—This is carried on whenever, from the appearance of the plants, it is required. The ground is hoed and the plants earthed up after each watering until the plants become too big to allow of men working in the field.

Tapping and pulling off suckers.—When the plants are about 3 feet high, or, if weakly-looking, 2 feet, the top shoot is plucked off (this shoot is plucked off, directly it makes its appearance in small or sickly plants), also the lower leaves which are dirty and draggled, and from 7 to 14 leaves are left, according to the strength and growth of the plant, the principal object being to get a few large and well-developed leaves in preference to a quantity of small ones. The side shoots or suckers are plucked off the instant they appear, and are left on the field for manure.

Frenching and grubs in the plants.—In frenching, the leaf puckers up and is only fit for the native market. If a grub be found in a large plant, it should be cut out with all the affected part and all the portion of the plant above it—a side shoot may be allowed to grow which will give a fairly good plant.

Signs of maturing.—Tobacco ripens in about three months' time. It is cut during the months of November, December, January, February, to the middle of March. A ripe leaf has yellow spots on it. It has a crumply look, and if bent between the finger and thumb will break.

The cutting and drying of the tobacco as described in Kumar Gozendra Narayan's memorandum, pages 22 and 23, is totally different to the system pursued at Gazipur. Does not Kumar Gozendra Narayan's memorandum refer to cutting and curing for cigar tobacco only?

Cutting or harvesting.—The cutting commences directly there are sufficient plants ripe in a field to fill a curing barn. The plants are cut off bodily at the stem just below the lowest leaves of the plant. The plants, when cut, are left lying with their butts towards the sun in the field to wilt. The time a plant takes to wilt depends on the heat of the sun. Usually half-an-hour is sufficient. When wilted the plants are either carried or carted to the curing barn. There they are spiked on split bamboos. In the French system the leaves are plucked off the stem and hung in the barn on strings.

Spiking and hanging in the barn.—Each coolie is provided with an iron spike which he fixes like a spear head on to the bamboo stick, he then takes a plant of tobacco in his hand fixing first the other end of the stick into a hole in a block of wood provided for the purpose which he holds between his toes. The plant is placed with the butt on the spike about 5 or 6 inches from the end and the plant forced down over the spike on to the stick. From 6 to 10 plants according to size are hung on one stick which is 4 feet long. These sticks are then hung in the barn; the stick should be hung so that the leaves may touch each other slightly, but should not press against each other. The barn is fitted up with a scaffolding of bamboos. The bamboos are 3 feet 6 inches apart and 4 feet above each other, the lowest tier of bamboos being 6 feet at least from the ground (where the tobacco is intended to be cured by fires). The barn is provided with as many doors as possible, those on the west side being made as air-tight as possible. Ventilators in the roof made to open and shut are advantageous. Rooms can be made any size. A room from 35 to 40 feet high and 30 yards long by 15 yards broad is preferable, as it can be filled rapidly, and will hold sufficient tobacco to cure well.

Curing and Drying.—When the barn is full (it should be filled as rapidly as possible in order to prevent the tobacco drying out in hanging), all the doors are closed, and also the ventilators if any. It is left for two or three days. The planter can now tell whether the tobacco is drying up too rapidly or not fast enough. If the tails of the leaves curl up and break when handled, it shows that the tobacco is going up too fast; on the other hand if there is a sour smell in the room and the plants sweat, the tobacco requires air and perhaps fires. In the first case the doors and ventilators are still kept closed and fires are lighted in different parts of the room, or if the house is filled with flues (which are preferable to open fires) hot air is carried through the room in the flues. The temperature will probably be raised 80° Fahrenheit, but this can only be told by experience. The tobacco must be carefully watched, and if drying too fast, the temperature lowered and water sprinkled on the floor. Raising the temperature causes the tobacco to sweat and the moisture thus created in the house makes the colour run in the leaves. The leaves should turn gradually yellow and then brown. If dried too rapidly it retains its original green colour. If it is intended to cure golden leaf the temperature is raised to 140° Fahrenheit or higher at the stage in which the tobacco has changed to a yellow, but this curing cannot be attempted in a hot climate, except by an experienced curer. Golden leaf realises double the price the dark leaf does. The plants should originally all be in the same stages of ripeness to ensure success in bright or golden leaf curing. In the above, curing in a hot dry climate like Gazipur is referred to; in Tirhoot in mild weather tobacco can be cured without any fires. This process will now be described. If, as in the second case stated above, after two or three days hanging in the barn tobacco feels soft, then there is a sour smell in the room and the plants may or may not sweat, then all the doors and ventilators should be opened and kept so until the sour smell is gone and the sweating has stopped; if that is not effectual then fires must be lighted. The curer must now be guided by the weather, and must carefully watch the tobacco. If the tips of the leaves begin to curl, it is going too fast and the doors must be shut during the day and opened only at night to allow the cold air to circulate through the room, the main object being to make the tobacco dry up gradually to yellow, and the greater part of it will turn reddish yellow called medium bright. The temperature must be regulated by the doors and ventilators. This air-curing makes a lighter brown than the firing process, and can only be adopted in a climate in which there is a certain amount of moisture in the air. If the tobacco sweats badly, doors and ventilators must be opened, and fires lighted, and a heat raised till it stops. Green tobacco is preferable to sweated. There is another process followed in some parts of America called sun-curing. In this process a scaffolding is erected under the shade of a tree, and after the plants are hung up, the whole is covered around and on the top with straw. The straw is opened out when it is found necessary to quicken the drying. This style of curing is hardly adaptable to the plains of India.

Flues.—Flues are iron pipes, fitted up a little above the floor. The hot smoke carried through them finds its exit in a chimney at the end of the room. The fires are lighted in furnaces outside the building or just inside with the furnace opening outside. It has many advantages over the open fires, as no smoke stagnates in the room to taint the tobacco, and the risk of fire to the building is reduced to a minimum. The temperature can also be regulated better. For a room 30 yards long by 15 yards broad, you would require three furnaces: these furnaces are built of pukka masonry. The pipes should be 15 inches in diameter. The pipes should be arranged so as to spread the heat equally through the room. Tobacco should not be hung directly over the furnace as the heat would dry it up too rapidly.

The higher the barn is the better it is for curing purposes. The highest tobacco in a room is usually the best colour, if you have a thick roof, otherwise the centre is the best.

Bulking, sorting, and banding.—The tobacco is generally cured, so far as its colour goes, in a fortnight or three weeks. It is left to hang through the hot weather in the barns, as the heat makes it too dry to handle. Early tobacco may be ready to bulk down in the Christmas rains. No tobacco should be bulked until the sap is entirely dried out. This can be seen by breaking the stem of the leaf. If bulked with sap in it, it will rot.

Directly the rains commence in June and the tobacco has become soft and pliable, it is bulked down in heaps in the curing-room in which it is hung. The heaps are raised some 8 inches off the ground by a small scaffolding made up of bamboos and stick, so that air can circulate underneath, and are covered over with straw or matting. The tobacco should not be bulked down in too moist a condition. The best order for bulking is when the tobacco is just soft enough to handle without breaking. If too soft it must be fired and allowed to come in order again. When all the tobacco is bulked down, the bulks must be opened and the leaves stripped from the stem and tied in "bands" or "bundles" with about 50 leaves in each band. The band is tied round with a leaf of tobacco tied round the upper ends of the leaves and and tucked in at the centre of the bundle; these bands are now carried to the head barn or sorting-room. They are re-bulked here in the same way as before. When all the tobacco is in the sorting-room, the bulks are again opened and the bands being untied, the leaves must be sorted. They should be sorted into—1, long leaf dark; 2, short leaf dark; 3, long leaf bright; 4, short leaf bright; 5, lugs—that is, all torn or dirty and very small leaves, red and bright, being banded separately; and 6, green—six varieties in all. The sorting is most important and requires strict supervision. Care must be taken that the coolies do not make unnecessary breakage in handling the leaves. They should be tied in bands of from 15 to 20 leaves. These bands are again bulked and left in bulk till packed. The bright is divided into four varieties, should there be any golden leaf. Golden leaf is, pure yellow. In this case you have—1, bright long leaf (that is golden leaf); 2, bright short leaf; 3, medium bright long leaf; 4, medium bright short leaf. Lugs are often made into strips by taking out the thickest portion of the stem midrib; two-third is taken out one-third of the way from the tail of the leaf. It sometimes sells best in this form.

Packing.—The tobacco is packed in hogsheads made of thin staves. The hogsheads are made 4 feet in height, and about 3 feet in diameter for despatch to Europe, or else after the native custom in bales. The tobacco should be packed as dry as it can possibly be packed without breaking it. It is generally necessary to hang it again in a barn, the bands just slung across the stick, and fire it till sufficiently dry. If too dry, the doors may be left open at night when it will probably be found in the right order on the following morning. The bands are packed with the butts outwards and tails inwards. There are three lines in each row, two with their butts at the edge of the hogshead and tails meeting in the centre of the hogshead, and one in centre of the hogshead. The next row is commenced from the other side of the hogshead. When the hogshead is filled, it is pressed down with powerful screws, and refilled, till it can hold no more. It should contain 900lb. of leaf as nearly as possible.

G. CAINE.

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VOL. VIII.] CALCUTTA :—SATURDAY, SEPTEMBER 1, 1883. [No. 9.


SUTTONS ENGLISH SEEDS
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TRADE MARK
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CONTENTS :

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarante of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGMENTS.

Annual Report on the Lunatic Asylums in the Punjab.

Report on the Administration of Criminal Justice in the Punjab, 1882.

Report on the Jails of the Punjab, 1882.

Report on the Excise Revenue in the Central Provinces, 1882-83.

CORRESPONDENCE.

TASAR (SILKWORM) CULTIVATION.

(*To the Editor of the Ceylon Observer.*)

Sir,—In Major Coussmaker's Report on his experiments in 1881, there are one or two points which call for the attention of all interested in the cultivation of the wild silk-producers. The experimental clearing established at Poona (the expenses of which are defrayed by the Indian Government) consists of a plantation of *Lagerstrœmia Indica.* The plants are grown at the distance of one foot apart in the rows, seven feet between each row, and the shrubs are kept topped at the height of four feet. All branches are removed with the pruning-knife as fast as they are bared of leaf by the worms, and in this way a constant supply of succulent foliage is produced.

Major Coussmaker states that in the Ahmednuger Collectorate the natives habitually cut back their trees very hard, two-thirds of the trees being pollarded each year, and that this system of cultivation is "most favourable to the Tasar worm, for the constant lopping of the trees and burning of the branches and leaves harass the squirrels, birds, lizards, and wasps, while the fresh shoots which spring from the mutilated trees afford the best food possible for the worms." There can be no doubt that the natural foes of the worms are in this way put to a great deal of inconvenience, and that the constant attention rendered necessary by the process of regularly pruning the shrubs, which Major Coussmaker recommends, makes the destruction of lizards and other enemies a rather easy matter, but I cannot concur in the opinion expressed as regards the suitability of the tender foliage as food for the worms.

In the cultivation of the mulberry-feeding worm *Bombyx* neglect to supply mature leaf has largely tended to increase the debility which either too great kindness, or too little care, has engendered ; and it seems reasonable to suppose that the wild worms, which in their natural state never devour the young leaves unless driven to do so by a scarcity of food, should become speedily debilitated when fed on immature leaf. In attempts made to rear the *Atlas, Militia* and other larvæ indoors on branches, the stems of which are plunged in water, it is invariably found that the foliage becomes, sooner or latter, distasteful to the worms, and although the strongest of them may escape disease and spin good cocoons, the majority are more or less affected by the excessive moisture in the leaf. The same deterioration is produced by severe or frequent pruning.

Major Coussmaker attributes his want of complete success to the existence of some climatic influence that he was unable to contend with, or to the worms having been attacked by small spiders, mosquitoes, or other minute enemies. It is quite possible that many of the worms were killed by insects, but detection in cases of this kind should not be difficult, and I think it almost certain that it was the want of properly matured leaf that caused his losses, since he himself admits that some of the worms commenced spinning before they were full-grown.

M. Wailly, in one of his reports on silk-producing worms reared in London, mentions an instance in which a number of *Selene* and *Luna* larvæ which which were fed upon a nut tree, that had been tapped and heavily pruned, died one after another, although other worms from the same brood of eggs reared on other trees growing close by, but unpruned, spun very fine cocoons.

It is of the utmost importance that the cocoons produced, whether of Tasar or other wild species, should be as free as possible of the cement which the worm natually secretes. Mr. Thomas Wardle, in his recently published handbook of "The Wild Silks of India," states that Major Coussmaker has succeeded in obtaining perfectly white silk by causing the Tasar worm to void all its cement before allowing it to spin its cocoon, but particulars of the method are not given. Inasmuch as the quality and quantity of the cement in the wild cocoons depends largely on the health of the worm, it would seem that in the production of Tasar silk by Major Coussmaker's method a decrease in the amount of the cement must be accompanied by corresponding loss of vitality in the worm. And this is a very serious consideration, because it raises a barrier in the way of progress towards the domestication of the insect, for it would. of course, be useless to attempt to utilize for breeding purposes cocoons, spun by worms whose constitutions had been impaired in this way. Any naturalist, I suppose, who has studied this subject, will admit that the silkworm, when it is prevented, by any cause, from commencing to spin its cocoon at the appointed time, is more or less injured by the delay; and there is also a considerable loss of silk to be taken into account. It is only by rearing one brood after another, and by feeding each successive generation on the same kind of plant that any real progress can be made. The moths of this species do not readily pair in confinement, at first, and it would add considerably to the cost of production if the sericulturist were compelled to rely on any of the wild insects he might procure in the jungles for renewing his stock.

It is in another direction that we must look to effect an improvement—from the manufacturer's point of view—in Tasar silk. What is required is that the food-plant should be of such a nature that the worms reared on it would secrete as little as possible of the cement, which at present so greatly depreciates the value of the cocoon; the plant should also be one on which the worms are easily reared. If these conditions are fulfilled, one of the greatest difficulties in the way of Tasar cultivation will have been removed. There are probably many indigenous trees which might be utilized with this object, but prolonged experiments will be necessary to enable us to ascertain the most suitable, and in this investigation the chemical analysis of various kinds of foliage might be of great service. In judging of the effect of the food on the silk, it is important to bear in mind that temperature and other surrounding circumstances exert some influence on the colour and texture, and it is not safe to infer from the appearance, size, and weight of a few individual cocoons that the food-plant on which they were produced is beneficial or otherwise. The Tasar worm is extremely polyphagous, as much, perhaps, in the Ceylon hills as in the low-country; and it is impossible for worms proceeding from such a parent stock to produce cocoons of uniform character until they have been reared through several generations on one species of food-plant. In a former letter on this subject, I mentioned, I think, that the Tasar worm was found in the hill country feeding on the loquat and the Avocado pear trees. I have not had sufficient time to ascertain whether either of these would be of use in the direction indicated, but experiments might easily be made with them. The sapu is another tree from which good results might be expected, but as I have not yet heard of a single instance of the Tasar being found in a wild state on this tree in Ceylon, it is probable that a good deal of patience should be required in inducing the worm to adopt it. Whatever trees are selected, it is essential that they should be perfectly healthy: no foliage that has been 'forced' by heavy pruning, by manuring, or by irrigation, can be good food for the worms, and trees that are shaded or deprived in any way of their proper quantity of sunlight are equally objectionable.

I have mentioned the sapu as being probably one of the trees best suited to our purpose. In "Silk in India," compiled by Mr. J. Geoghegan, I find the following note on the silk of *Antheræa Assama* (a closely allied species, if not a variety merely of *A. paphia*):—"Champa: the silk produced from the worm feeding on this plant (*michelia*) gives the finest and and whitest silk." There is another tree which may probably be made use of since it is commonly met with in the jungle over 4,000 feet elevation. It is the tree the leaf of which so closely resembles the tea leaf that coolies are hardly able to distinguish them. It is probably *Eurya serrata.* The Atlas worm feeds on this tree in India, and there should be no difficulty in getting the Tasar worm to feed on it also.

In Dimbula worms of Atlas, Selene and Mylitta have been reared on the Avocado pear and on loquat, and in their wild state these three species may be found on the so-called "patana oak," the *kahata.*

There are other species of wild silk-producers, the cultivation of which might have give even better results than the Tasar, but the acclimatization of these is matter of time, and the commercial value of their silks has yet to be ascertained.—Yours faithfully,

PERCY N. BRAINE.

The Indian Agriculturist.

CALCUTTA, SEPTEMBER 1, 1883.

AGRICULTURAL BANKS.

THE question of Agricultural Banks is at present occupying a considerable amount of attention. Generally stated, some such opinions as the following are gaining daily in strength the banker namely that is devouring the cultivator by usurious interest, and if Government were to take the place of the banker, it would be satisfied with less interest. As a contribution to the literature of the subject, we present our readers with the following article, written by one who is in hourly contact with and who lives among agriculturists. The article therefore embodies the opinions of a man who knows the people well:—

The prime cause of the great need for bankers, among landowners and cultivators—poverty and indebtedness—is seen by all to have its foundation in increase of population, not followed by sufficient emigration.

The peace and protection to life and property afforded under British rule have obviously tended to greatly increase the population. The natives of India receive the advantages of civilization, but refuse to throw aside ancient usages, &c., failing from want of knowledge to realize how unsuited they are to the present rule, how, though once perhaps essential to the proper working of an obsolete administration, they are now only anomalies, and as such must eventually die out.

The practice from the continuance of which we confidently believe most serious consequences are to be apprehended, is the one by which a man's estate is divided equally among all his children.

There was a time when lawlessness was the rule in India rather than the exception, as it now is, when a man's wealth was protected, and represented by the united physical strength of his family; and we can imagine how a father—in fact, a whole family—would grieve over the departure of a stalwart younger son capable of using a sword or wielding a *lathi.* In those times every inducement would be offered him not to leave the family, and none more reasonable than an equal share in his father's property. Uncultivated land was to be had in plenty then, nea[illegible]ome, and as a family increased in numbers, the area of land required for its support could easily be increased. Population, however, increases indefinitely, but the area of a country is limited. Because of the increased area under the plough, the value of land has increased. We can point to a village in the Agra district which was sold about 60 years ago by public auction for Rs. 800, and is now well worth, at 3 per cent profit, to the purchaser Rs. 1,25,000.

The youngest son of five of a zemindar—the owner [illegible] "one *biswee,*" 1/20th share, perhaps 20 acres of a small [illegible]ge—is brought up to consider himself a gentleman and a zemindar, and is hourly stuffed by his foolish relatives with all sorts of stupid ideas and tales about the extravagances that denote the *amir*, or gentleman. After his father's death he is put in possession of his property—a pair of lame oxen and four acres of land. The career of this man need scarcely be

traced. The money-lending speculator is soon in possession of his lands, but this, instead of being a blessing to him, as calculated to induce him to leave the locality where there is no room for him, and emigrate to some more sparsely cultivated tract, has been a curse by (under the present circumstances only) our misapplied protection which allows him "a proprietary right," and induces him to cling to the shadow of his wretched property. This is the stalwart young *lathi-wala* once so essential to, but now the curse of his family,—with a vague sense of wrong done him, associating with thieves and burglars, in preference to working, and determined not to leave the scene of his former affluence! What is the use of preventing the sale of the property of an indebted zemindar not the proprietor of an "impartible estate," with the object of preserving him, when his own loins can produce the dragons that will devour him, and throw his name into oblivion. If we must have a wealthy yeomanry and cultivators with well-filled stockings, or rather jewel-be decked wives to draw from in times of scarcity, we must have emigration, and to have this, the rule of primogeniture or any other that gives the property to some one person must prevail, everywhere, even with occupancy rights. All the present absurd objections to emigration would disappear before the courage that nothing inspires so readily in a man, as being "put into a corner." When the younger sons learn from infancy that they have nothing but their own intellects and good right arms to look forward to for their support, they will gradually populate all the habitable waste lands of India, and with the support of wealthy elder brothers, too, whose interest it will always be to start off the younger in life, and at a distance from home, and when these lands are no longer available, they will probably have the courage and enterprize to stalk out and establish in some other clime a *Ram* Company as we did the Honourable East India Company among their hearths, instead of, as is now the case, being obliged to be huddled off as *coolies* for their country's good. It is then that the railways will show to perfection, when they distribute and equalise the people just as they now do grain only, and thereby cause local distress very difficult to trace or remedy. We should make every endeavour to induce native gentlemen to discuss this question of inheritance, for the initiative must come from them; and if they possess an atom of patriotism, there is not the least doubt that a reform will be established.

We will now endeavour to explain who the banker or sowkar is. Happy is the cultivator who can furnish his own *rabi* seed! There is no more certain evidence of incipient prosperity, and why? Because he has had the whole year before him to *trade* with it. Well aware that profit in trade is largest where most labour and pains are taken, he lends it out on interest, in small quantities, to his less fortunate neighbours, recovering it before his own sowings commence. He is now a banker, a small sowkar, dealing only with grain, and repeating to himself the proverb, "*An dhan onek dhan*: *sona chandi adha dhan*" grain wealth is great wealth: gold and silver is but half wealth) meaning of course that you will not lose by it. In seasons of scarcity as soon as his capital has increased sufficiently, he elects a few regular customers, calls them his *assamis*, and treats them in a manner that will be described hereafter. It is, without exception, the aim and ambition of every cultivator to be a banker, as he acquires wealth most surely by these means. His reason for this, as most other native reasons from facts difficult of comprehension, are puerile quibbles and superstitious notions. This is what one of them told us:—"What can you expect fron *matti mata* (mother earth) but what a child expects from its mother, *viz.*, food? Confine yourself to cultivation alone, and the good and bad seasons will, [illegible] themselves as to leave you a bare subsistence because the surplus money is *manhus* cursed, or if this is not the corrent translation, uncanny. Do not we say *dhori aur jhori*, the earth and a daughter, meaning therby that the profit acquired from both, in the case of the daughter, by her sale, are as accursed as each other? You must combine trade with cultivation if you wish to be wealthy, for it has the effect of taking the spell off the profit from cultivation alone."

Let us imagine a cultivator of ten acres who has a clear profit of Rs. 30 at the end of a season, in excess of all his requirements. What would we have him do with it? Surely not hoard it. The locality is so thickly populated, and occupancy rights so prevalent, that he cannot secure a single biggah of land over and above what he already holds. He cannot, while yet so poor, or indifferently rich, take up a trade that will require his presence at any distance from home. If he has not intelligence enough to perceive himself that cultivation is never successful unless carried on under the direct supervision of the person who is to reap the profit, the proverbs of his fathers tell him so. *Kheti patti binti our ghore-ke tang, apne hath samaria lakh log hoe sung*—cultivating, letter-writing, petitioning and the girthing of your saddle should be performed by you personally, though a hundred-thousand people be present.

Khete aur khasamsete—which may be explained—to be a husbandman, you must be a husband to your cultivation.

Kheté kure banjg ko dhani dono mee sék na pavé—If you attempt to carry on farming and transport trade together, you will reap profit from neither. Then what trade can his rural imagination conceive, or what does he understand better, or that he can more conveniently attend to—hampered as he is by the cares of a husbandman—than lending grain to his needy neighbours? We will call him the agricultural banker.

The next—the speculative banker. The *banya*—or *mahajun bohree* or proper, who settles in a district with capital that he brings with him. He combines two callings, which place him at a great advantage over the average agricultural banker—lending money, or rather grain, in the ordinary way to needy cultivators, and doing a large transport trade with agricultural produce. He is very often the agent of a wealthy merchant residing in a city, and were it not for the competition of the agricultural banker whom he is always striving to suppress, he would be complete master of the situation which would place the cultivator in a much worse position than he now is.

Then we come to another, the zemindari banker. He is undoubtedly the worst of the three. This sounds inconsistent, and will require lengthy explanation. The speculative banker settles in a village with the permission of the zemindars, and according to the extent of his capital takes up the maintenance of ryots. The most ancient description of the trade was apparently giving the grain to the applicant at one seer above the market price ruling on that date, and receiving it back at the harvest rate. What we call the harvest price is spoken of by natives as *aktij ka bhow*—the *aktij* rate; *ti* means third, and the prefix *ak*, or rather *akh* meaning death, is added to define the particular 3rd day of the 2nd half of the Hindi month of *Baisakh* (between 23rd April and 23rd May 1883), as it is one of the two days of the year on which offerings of oblations to the souls of departed relations is an imperative duty on Hindoos. This is also the date for which the harvest price is fixed. A few days after the *aktij* the cultivators, soukars, zemindars who are interested in the welfare of their tenants, or their representatives, putwary and weigh-master, meet with the object of fixing the harvest price, whch they do by taking the mean of the prices that ruled in the nearest large mart a couple of days before and a couple of days after the third of the second half of Baisakh. Both sides—the money-lenders and those that deal with them—argue the matter, giving instances of sales, &c., and when the price is settled to the satisfaction of all, the banker is paid back at one seer more per rupee than whatever rate has been fixed upon. Of course, grain is cheapest at this time of the year, and when prices fluctuated a great deal, we can readily see how this simple system used to bring a certain and good profit to the sowkar; but it is now not much resorted to, particularly in localities within easy reach of the railway, which we know to have the effect of equalizing the price of grain, keeping it pretty regular all the year round, which would of course lessen the interest, when this is only the excess of the harvest rate over the average rate of the years. However, it is nowhere quite set aside, as we will see when treating of the banker's account book. Our reason for believing it to be one of the oldest systems of banking, is that the wor-

for trade in the most ancient Hindi now spoken is *tijarath*, obviously derived from *tij*, the third day of the month, and *arath* security, or the security of the third.

Many writers have expressed themselves of opinion that the fixing of the harvest price is entirely in the hands of the buniya, and is a great hardship on the cultivator. If this were so, the country would have been ruined long ago. We do not place any dishonesty beyond the buniya, but these gentlemen have evidently lost sight of the fact, that though buniyas as a caste are very apt to form leagues, this particular trade is, in agricultural tracts, carried on under the competition of every caste of natives in India, for reasons that we have given, and that it is very difficult, if not impossible, to form leagues under the circumstances. It is only in towns where there are no agricultural bankers, and the grain vendors are almost all buniyas by caste that tricks can be practised. Then, again, out in the district, where cultivators are continually appealing to you about wrongs done them, a complaint against the validity of the harvest price is never heard, when the *aktij* rate has been duly fixed in a large village, the neighbouring villages generally save themselves the trouble of a conference by accepting it. A favourite adage with them is *bhao aur bursat* or prices and rain, meaning that they are as much dependent on chance as each other. In the same way a harvest price used to be fixed for the kharif harvest called *mirigsir ka bhow*, in the month of *Mirigsir* or *Aghan* (between the 15th November and 15th December 1883), but it is now very unusual to establish it with any ceremony.

We are now to see how the banker deals with his *asamis*. He has advanced one of them, we will say, Rs. 100, to be paid from the *kharif* harvest carrying interest at 2 annas per rupee for 6 months, or Rs. 25 per cent per annum. The money has been advanced gradually, supposing that there is no security but that of the crop—Rs. 20 (afterwards to be spoken of as grain) perhaps for a plough bullock; the price not being put into the cultivator's hands, but paid to the cattle-dealer either by the banker himself, or through a trusty servant, Rs. 40 for food given at intervals, and Rs. 40 for rent.

Before giving cash advance, the banker, seized with a fit of nervousness, will walk over his patron's cultivation to see that it is not being neglected in any way and will stop advances if it is. The asami is supposed to feed himself from about the 15th August to the 15th November from the Indian corn, *bajra*, *mot*, vegetables, &c., that he has sown, and the banker does not demand these crops, unless he contemplates throwing over the cultivator, expecting himself only cotton, *juar*, *masina*, &c. After this, and up to the 15th March, he will feed him on barley, never allowing more than 2 maunds, 20 seers (ordinary weight) per month for a family of five; salt and condiments must be procured by exchange from this allowance.

Very much the same is done in the *rabi*, seed of course being a heavy charge here, though scarcely anything in the *kharif*, the cultivator has to supply himself with food from about the 15th March to the 15th June, and does so chiefly from such crops as potatoes, carrots, *methi*, spinage, and is allowed to pluck a little green wheat and barley or grain.

The banker takes over the whole crop, allowing only the debts of customs to be paid on the threshing-floor. The village barber, potter, carpenter, washerman, water-carrier, family priest, and *bigari chamar* (a gentleman we shall write about on some future occasion) who each get, what will on an average come to about 25 seers of grain per plough, and charges interest on every item paid by him, but for such portion of the rent, which is always last considered, as is covered by the value of the produce.

It is the due payment of the tenant's rent that makes the zemindar support the soukar. It is usual for the latter to give him *rukka* or informal note of hand in favour of the tenant, pledging himself to pay the rent when the cultivator's crop is reaped. This is really no binding document, in the ordinary sense of the word, as it is neither stamped nor witnessed. It is only a note from the banker, acknowledging the cultivator to be a solvent customer of his, and one he does not intend throwing up. So identical are the interests of banker and tenant, at a certain period, that these *rukkas* are as safe as possible, and such a thing as their being dishonoured is almost unknown.

The zemindar has now the upper hand of the banker, for if he was to eject the tenant, it would be impossible for the latter to collect his balances. So long as the interest already realized by the banker will not cover the anticipated loss, and leave a margin of at least 12 per cent profit on investment, this state of affairs remains, and the cultivator is supported by a capitalist who is bound in his own interest to furnish him with advances when necessary, but as the ryot says, *kismut phutah, aur buniya chuta*; that is to say—the buniya deserts you with the appearance of misfortune. The time comes when his cattle die to a calf, added to which is perhaps the loss of a couple of able-bodied members of his family, or probably worse, and the crop does not represent the full rent, or perhaps just it. The buniya now informs the zemindar that the security for his money has decreased so much in connection with this cultivator, that he can only afford to give a *rukka* for two-thirds of the rent. The zemindar cannot object, for he is told that if he does, and distrains the crop, the buniya will throw over the tenant, and he shows that having made such a large interest, about 50 per cent, previously, he can afford to do it, and show a fair profit in spite of the money he loses by doing so. Now, the question is, will the zemindar come to terms with the banker, or will he distrain, and secure all his rent for that season? In the latter case, he would be burdened with not only one impoverished tenant, who would require advances to keep him going, but one deeply indebted to a merciless creditor, no longer interested in his welfare, who, with his fraudulent bonds and decrees, and executions, would neutralize all the good effects of the advances, and give a great deal of trouble generally.

In the majority of cases, the former course is preferred, and the buniya allowed to risk his money in another year's trial. This season most likely decides the fate of the cultivator between a long term of indebtedness and perfect beggary; another bad season, and the buniya throws him over, with, by reason of his purely mercantile training, as little compunction as he would discard a worn-out pair of shoes. Prayers are useless with this class of people, who would say what an English-speaking Bengali was heard to utter: "Money matter no friendship."

It would be a dead loss to a zemindar, or something very near it, to keep such a cultivator any longer in a thickly cultivated country, where land is at a premium. The man's ruin being chiefly due to the very high interest he has been obliged to pay, the land itself will generally bear enhancement, and it is accordingly made over to some solvent ryot on an enhanced rent, the enhancement being looked upon in the light of a recovery by instalments of the arrears of the ejected tenant.

The following figures will show the percentage of interest realized by a soukar from an assami he is supposed to have advanced Rs. 200 during the year. It will be seen that the old aktij system we have already described is so mixed up with the new one of two annas per rupee per harvest as to make it exceedingly doubtful whether the "country lout" can really understand the terms he has accepted, or the interest that he is paying:—

Kharif.

	Rs.	As.	P.
1—Registered value of grain advanced at intervals at the rate prevailing on each occasion ...	100	0	0
2—Interest at 2 annas per rupee per *fasil* ...	12	8	0
3—Interest, the result of deducting 1 seer per rupee's worth of grain when making advances, taking the average price of grain at 20 seers per rupee ...	5	0	0
Total ...	117	8	0
Deduct item No. 3, already realized	5	0	0
Balance due by tenant at end of *kharif* ...	112	[illegible]	[illegible]

This being a half-yearly account and the sum really paid by the banker Rs. 95, it looks like an innocent Rs. 36-13-5 per cent per annum. But when we reflect that this balance, if cleared, would be paid at harvest time when grain is at the very least 20 per cent cheaper than the average rate of the past six months, and that it would be paid at one seer above this rate or five per cent more, we find that the deluded ryot will have

really paid Rs. 28-4-0 more. That is, the soukar gets Rs. 45-12-0 within 6 months for Rs. 95 laid out, or 96-5-0 per cent per annum.

Let us suppose that he does not pay up in the kharif, and that the balance is carried over to the rabi. It would stand thus if he paid up at the aktij:—

Rabi account.

	Rs.	As.	P.
4—Balance of kharif	112	8	0
5—Interest on kharif balance of Rs. 100, minus kharif interest at 2 annas per rupee per fasil	12	8	0
6—Compound interest on kharif interest of former account item No. 2 at 2 annas per rupee	1	9	0
7—Interest of 5 per cent on items 4, 5, and 6, by receiving grain 1 seer above market price	7	5	3
8—Recorded value of grain advanced at interval, at the rate prevailing on each occasion	100	0	0
9—Interest at 2 annas per rupee per fasil on item No. 8...	12	8	0
10—Interest of 5 per cent while advancing grain (No. 8) 1 seer below market rate ...	5	0	0
11—Interest of 5 per cent while receiving back grain (No. 8) 1 seer above market rate ...	5	0	0
12—Compound interest of rupees 5 while receiving back (No. 9) at 1 seer above market rate	0	10	0
13—Profit, the result of the difference between the average rates of the year and the harvest rate at which the debt is paid, on items 6, 4, 5, 8, and 10—20 per cent, about... ...	42	0	0
Total ...	305	0	3
Plus rupees 5 received in the kharif ...	5	0	0
Total ...	310	0	3
Deduct actual sum paid...	190	0	0
Profit ...	120	0	3

This is about 63 per cent which bankers will acknowledge to, as being only right and proper. In the event of such an unusual circumstance as prices falling below the last harvest rate, the cultivator is forced to receive advances at the latter rate, being told that it is the identical grain he paid last harvest, and that he surely does not intend taking it back at a cheaper rate than he gave it.

This is the toss-hazard on the principle of "heads I win and tails you lose," in right earnest. Yet soukars complain that they are often ruined. We do not doubt it, and it is painful to think of, but the sadder reflection remains that their customers must have been utterly annihilated.

The question is, does the zemindar profit most by supplying advances himself? If he is a large landowner he cannot afford the time to attend to such a difficult business. Cultivators are too improvident, and too accustomed to the "feast-or-starve" principle of life, as a rule, to be entrusted with money in lumps. It must be given in small instalments, and the advancer must make sure that it is used for the purpose it is given for only; this is by no means an easy task, or one that can be entrusted to native servants; such tenants will grind and devour choice wheat given for seed; will sell oxen purchased for them; and several have been known to produce the same ox when told that they would not be entrusted with cash till they showed the animal they intended purchasing. Besides this, those requiring advances being chiefly impoverished and thriftless tenants, certain to be already in the zemindar's debt, there is not an atom of security for his money.

There may have been a time when the zemindar was the *má-báp* (father and mother), the chieftain of his village, with perhaps the life and death of his tenants in his hands; when he used to show magnanimity towards them, and pride himself on their being happy and prosperous. We have established a different condition of things; the zemindar is now no better *in his own opinion* than a common lessee, a servant collecting money for us, and money the regular payment of which we must enforce with the utmost rigour. Setting aside the matter of occupancy rights, the lowest caste of cultivator stands on an equality with a zemindar of the highest caste in open court, and could be the means of getting him flogged, notwithstanding that the latter would not and could not touch him without contamination. This is the law of civilization, and we would not mention the matter were it not to show, that for a great while to come, we must expect no poetry from the average native zemindar, and having taken the chieftainship into our own hands and deprived the ryot of his *bap-má*, must act the part ourselves.

The zemindar's interest in the cultivator is purely mercantile just now; no poetical sentiments regulate his conduct towards him, and we are afraid that in thickly populated tracts where land is at premium, it pays him better to eject an impoverished tenant than aid him with advances. If he is deeply involved with others, it is always his interest to eject him.

We will now find it easier to explain the position of the third or zemindari soukar whom we accused of being of the very worst class. We have seen that a banker deals with well-to-do tenants, giving them up when they are ruined, or rather, as is often the case, after he has ruined them, and left the inference that the model zemindar advances money to men already ruined with the object of re-instating them. This shows the difference between *takavi*, as agricultural advances are called, and *soukari* or banking. In the latter, the speculator, if careful, will never lose, but in the former he will often find that he is "throwing good money after bad." As long as the zemindar and banker are separate, both fear each other and restrict one another in extortion, and to a certain extent the ryot is a gainer, but where both occupations are carried on by the same individual, the ryot is an abject slave.

One would reasonably think that where the zemindar is also banker, it will never be to his interest to ruin a tenant; but a little reflection will make it apparent that it is rack-renting of the very worst sort. Cultivation in such villages is very indifferent, and the tenants always of the lowest castes, and even natives look upon it as very bad form. Every particle of grain first comes to his garners as it would to any other banker's. Between banking accounts such as we have shown, which is the simplest form, and land rent, there is seldom, if ever, a balance left to the credit of a tenant. So that this class of zemindars gets all the produce of his land for very, very much less than what it would have cost him had he cultivated himself, by hired labour, for which there is some competition. These cultivators are wheedled into the belief that they are ordinary tenants, and labour under this impression for a bare subsistence. The advantage to the zemindar does not end here; having all the produce in his own hands—for he would instantly eject any one that would not deal with him; he can afford to fix as low a rent as he pleases, and will give all his tenants, or more properly, slaves, occupancy rights before the settlement takes place, intending of course to make them resign, to a man, after the settlement is over, for, with the others, he hates occupancy rights. Is he not bound to be dealt as gently with by the settlement officer as possible? We can fancy the following dialogue:—

S.O.—"How very low your rents are, Pursram. Your liberality in the matter of occupancy rights does you great, great credit. I regret to say that very few have taken your example.

Z.—Ah, sir! it is the greatest mistake in the world to rack-rent your tenants. The Ganges bear me witness that *I consider* it a sin. My father's last injunction to me was not to oppress the ryots. "They are my children," were his words; and let the revenue be as high as it will, I cannot do it—death and ruin are preferable.

S.O.—But, Pursram, these settlement rates are not heavy.

Z.—Not for those who extract the last drop of blood from the poor, and those whose souls burn within them at the very mention of occupancy rights.

The interrogator, now confusing takavi advances and banking (two utterly different things, when the zemindar is concerned, as we have explained), probably says:—

I am told you have to lay out a good deal of money in takavi—strange, considering the lightness of your rents and the quality of the soil.

Z.—(Rising to go)—Sir, God is above and you are below; such is my fate *(dashing his hand against his forehead)*, but you see and hear everything, and it is not necessary for me to speak.

We fancy we can hear the shrieks of laughter that will rend the air from the *chowpal* of that canny thakoor that evening, and the sighs of his tenants.

Should Government organize agricultural banks, this thakoor will probably send all his tenants to secure Rs. 20 a piece at 2 per cent, or whatever it may be, would take it from them, and lend it out at 25 per cent, or start a grain trade with it—as sure as he is born. This class of banker should be suppressed speedily, and with a high hand. The first or agricultural banker deserves consideration. His competition is the greatest check we know of on the speculative banker, and his main business being the production of the grain, he cannot be forced out of the petty banking market, at all events, nearly every agriculturist that has an ounce of grain to spare deals with it in the way we have stated. It has the effect of distributing wealth to some extent and is antagonistic to hoarding. Were that to be suppressed by Government banks, more jewels would be hung about the necks of native wives and children, and more money buried in pots than is already done; for the cultivator cannot trust himself with another trade. The love of trade grows on human beings and gets as irresistible as gambling, and though we care not for the latter we should do all in our power to promote the former. When by means of banking with brother cultivators and money-lending (the particulars of which we have not entered into, as it does not concern cultivators so much as labourers and artisans) he has accumulated about Rs. 500, not less, he starts as a grain merchant, purchasing grain in the district and disposing of it in large cities; still retaining his banking work, but entrusting his cultivation to some competent and very near relation. Such a man is to the zemindar the pink of the present cultivators, for one who has acquired wealth by agriculture only is very rare. His cultivation is always of the best class, and even should he not be an occupancy tenant, his land has as much money expended on it as the anticipated profit will admit of. He knows full well that it will not pay the zemindar to eject him.

We wish to protect the cultivator, and tax this man daily for carrying on a banking business. This we certainly should not do when certain that he does not cultivate less than ten acres at least. It amounts to expressing ourselves satisfied if he sells his grain at once at a dead loss to a speculative grain merchant, and dissatisfied because he accepts all the risk and trouble of lending it to his less fortunate neighbours, and thereby securing a better price.

The soukar's interest is high; 63 per cent is very high we are aware, and that it is necessary that something should be done to protect the men that requires his services. But all soukars charge the same, and the fact of their being much competition among them, is very significant, and would point to the conclusion that the security offered very often is nothing more than the crop, and that, liable to distraint by the prior right of a third party, is very poor and insufficient. Such a thing as a banker ruined by bad seasons is by no means unheard of. If the security was better, there is no question about it but that a smaller interest would be charged.

Government agricultural banks would in all likelihood prove a failure, on account of the difficulty of management. Besides the difficulty of determining who can and who cannot be trusted, everybody that knows the class of cultivators that will flock to these banks will tell you that they must be treated like children; that it will never answer to put sums of money into their hands which they may keep at home, and spend gradually,—it being absolutely necessary to see that they do not misspend loans, but utilize them *for the benefit of the crop*, which is nine times out of ten the only security. They must be watched to see that, inspired perhaps with a feeling that the crop will not do more than cover their debt, and leave nothing over for them, they do not neglect it. The banker at present, as we have remarked before, gives the instalments in small quantities of *grain* and threatens to stop advances the moment he observes the least neglect; and he must be a good agriculturist to know what constitutes neglect—certain slight omissions and at particular periods often influencing the produce for the worse a great deal. Then, as the present law is constituted, it would be ruin to the zemindar if these banks in any way interfered with his right to collect his money before any other claimant, particularly such a powerful "limitationless" one as Government would be, or with his right of having the crop hypothecated to him. These are the only rights of any value left him, and their loss would cause a panic. It is also very questionable if the water-rate system would answer. There the advantage to both zemindar and tenant is indisputable, and the water cannot be misspent, so as to hurt either of them, whereas money given can. At present the numerous sowkars watch the interest of the zemindar unwillingly by enforcing proper attention to cultivation—a thing the large landholder (landowner would be a misnomer if applied to the zemindar) could never do without the assistance of a staff that could not be afforded, even if procurable. If, being the landowners, we are determined to aid the ryot, *why not stand surety for him*, doing so only when his banker is a brother cultivator? We know that bad security necessitates the heavy interest charged, and that between servant and servant we can expect no other relation than that of trick. With such security as Government could offer, 25 per cent per annum would be remunerative to incipient bankers, and much less to wealthier.

Some conditions like the following could be arranged:—

Every banker entitled to accept Government security must be registered.

None to be registered if cultivators of less than 10 acres, unless occupancy tenants, or able to prove themselves hereditary agriculturists.

Such bankers will not be taxed *(and some other social privileges must be thought of.)*

Cultivators, on the recommendation of three or more solvent and respectable brother cultivators residing within 3 miles of their village, to be given two foils of a trefoil security note of a certain value *(after paying a small premium, which may go to form a fund for the benefit of ruined agriculturists)*, which note they may make over to any registered banker they please to deal with, or that pleases to deal with them; the banker retaining one foil, and returning the other signed to the office that issued the note, to be pasted against the office counterfoil.

The whole matter would of course require much consideration. Means would have to be devised to prevent the soukar charging more than a certain interest; to prevent him paying away the money too rapidly; to prevent him getting careless as to the attention bestowed by the cultivator on the crop; to ensure his having rightly stated the amount he has paid, &c. Many of these could be managed by means of the surety note itself, by some such arrangement of tearing off slips as we have in the stock note. Conditions of the security would also have to be determined upon.

This would surely be more paternal, and contain less of the objectionable element of interference with free trade.

Perhaps if a premium of Rs. 1,000 was notified for the best essay on agricultural banking, in the Hindi language, and to be written in Hindi characters, facts would be arrived at that could not be elicited by any conference of Europeans, or wealthy native zemindars fishing for titles.

The non-agricultural banker should be properly held in check in his dealings with cultivators. They are almost always bunyas by caste, whose chief business is speculating in grain, and who only undertake the ruin—we cannot call it anything else—of cultivators. The high standard of intelligence among them enables them to take advantage of the telegraph (a sealed letter to the ordinary cultivator), combined with freedom of motion, not being hampered, and confined to a locality by husbandry, gives them too great an advantage over the agriculturist already, and it is a question whether they should not be still further suppressed, by a simple device we know of, by which the most ignorant and illiterate cultivator

could be made aware of the daily prices of grains in, at least, the nearest large mart.

W. C.

FRUIT AND FLOWER WINES.

IT is well known that the demand for wines far exceeds what is produced from the grape, and that their fabrication has for years been openly carried on in France and England. A different state of things prevailed of old, for fermentation was a phenomenon not understood, and the composition of wine was unknown. The blending, therefore, of the old wine with the new, and the addition of water, were the only sophistications practised. Now, it is different. The advance of chemistry has revealed what was formerly concealed, and men have not been slow to take advantage of this knowledge. As a consequence, the glory of the vine may be said to have departed, because all the romance chronicled in song and story is inapplicable to the almost indistinguishable imitations flauntingly sold as *wine*. The fact, however, that wines are artificially made tends only to confirm the growing demand for them; and the question occurs—why should we, because the production of the grape is insufficient to meet this demand, disregard other fruits which ferment in a like manner, and whose products operate in the same way? If we seek to ascertain why most men are content with the base imitations offered to them, we discover that they do not know what genuine wine is—that a wine is to them excellent because it is high priced, and genuine because the cask in which it is received bears a French name or the bottles' chaste labels in white and gold. A would-be connoisseur solemnly tastes such a liquor, and utters an opinion, although he has never to his own knowledge tasted a genuine wine; but that is nothing: he is a *bon-vivant*. He pretends, therefore, to a knowledge of wines which takes a chemical expert years to acquire, and which he (the expert) does not hastily apply. To these self-constituted judges do we owe the existence in the market of many a spurious wine, and by such judges are really good wines condemned.

Partly on account of their cheapness, and partly through frivolous report, ordinary fruit wines have not hitherto met with much favour, and but scant attention has been given to their manufacture. Notwithstanding this, they are still in use—it may be said by old women, priests, and shepherds. Well; we should prefer to be guided by the simple tastes of such people than by the opinions of self-constituted connoisseurs whose tastes have become vitiated by indulgence in the abominable apologies for wine vended in cities.

The relationship between ordinary fruit wines and grape wines is obscure to a degree: some believe them to be preserved fruit juices, and others saccharine fluids, flavoured with artificial fruit essences. To establish the fact of their actual connection is a very simple matter. Chemistry having ascertained all the changes which take place in grape juice in its transformation to wine—that is, the metamorphosis of certain of its components, the consequent evolution of certain gases, change in colour, density, &c., it is easy to follow the changes which take place when other fruits are brought under the same conditions and influences, and to compare their products. This has been done, and we have arrived at the knowledge that all fruits containing sugar and gluten are subject to the same kind of fermentation: that they will yield products of more or less potency, which, keeping in view the literal signification of the term *wine*, have all claim to that name, all of them bearing a higher hygienic interpretation than most of the so-called wines found in the market, and certainly not an inferior hygienic interpretation to that based on the components of pure grape wine. It is from a technical point of view, however, that we will chiefly [illegible] them in this notice.

Fruit wines in use in Russia are those prepared from the apple, bilberry, brambleberry, cloudberry, cranberry, currant, raspberry, strawberry, and whortleberry. In Great Britain we have in addition to these, wines prepared from the gooseberry, elderberry, cherry, juniper-berry, mulberry, the orange, lemon, fig, plum, pear, and other fruits. All of these wines possess in a very pronounced degree the characteristic *bouquet* of the fruits mentioned, and probably the medicinal virtues in a modified degree of the plants yielding them. They are mostly acid to the taste, and on this account very grateful to the palates of persons suffering from fever. This acidity can be removed, if desired, by the addition of glucose, preferably in the shape of honey, to the fruit juice prior to fermentation. Care must however be taken that an excess of glucose is not added, else the characteristic *bouquet* of the fruit will be masked. The blend, however, of the fruit *bouquet*, with that of the mead, is when carefully made very agreeable, resembling that of grape wine. The addition of elder-berries or elder-flowers to this blend, or to fruit juices whose fermentation products have no very pronounced odour, lends to such the flavour of Frontignac. The addition of glucose, for the purpose of modifying the acidity, results of course in the formation of more alcohol, a circumstance taken advantage of by wine fabricators, and to which we owe the existence of a superior class of artificial wines; superior in so far that they are harmless, but whose connection with the grape is like the imitations of a worse type, shadowy. They are in fact nothing more or less than fortified gooseberry and currant, with a dash of questionable sauterne. We allude to certain brands of champagne and burgundy, so called; *chateau* something or another with the year of the vintage given. It is something however to know that they are harmless, for in France where the ravages of phylloxera have forced manufacturers to extremities, the beet is employed as a substitute for the grape. Beet-root wine is a pale red liquid, possessing a disagreeable taste and odour, and containing varying quantities of propyl, butyl, and amyl alcohols. The latter is the well known fousel oil. It will therefore be understood that wines into whose composition fermented beet juice enters must be strongly excitant. We can understand the use of potato spirit in the manufacture of artificial cognac, but we can discern nothing of the proverbial elegance of French taste in the adoption of the beet as a substitute for the grape in the manufacture of wines. The very association of the two must be repulsive to most minds. We have then artificial wines, and artificial wines, some harmless and some poisonous, for that which gradually paralyses the brain cannot be regarded in any other light than that of a poison: the difficulty is to know the harmless imitation from the toxic. This being the case, and as no special measures are adopted by Government for the detection and suppression of the trade in such imitations, the question of utilising harmless fruits, analogous in nature to the grape, for the manufacture of light refreshing wines, especially in India, becomes of importance. Tropical fruit wines would, we venture to predict, find a ready market in England. The apparatus necessary for their manufacture consists of a few tubs, filters and presses; the industry therefore need not be confined to capitalists. Considering the excellence of some of the Russian and British fruit wines, it is a matter of surprise that they are not met with in commerce under their own names. In alcoholic value they are not inferior to certain kinds of burgundy, hock, champagne, frontignac and tokay, as evidenced by their utilization for the manufacture of imitations of these wines. Perry, as perry, is too cheap to be appreciated: as champagne it commands a ready market. The name of *gooseberry* is against the product of that fruit; not being sufficiently euphonious to suit the pseudo-æsthetic tastes of the average Briton. As *grossularian* it might be a success. Should low prices be against these wines, they might be improved up to any standard—dry sweet, still, and effervescing, and priced according to age. They differ generally from grape wine, in so far that they contain less alcohol, and less extractive. Following are analyses of samples of cloudberry and cranberry wine, in which the alcohol is very low. The amount of sugar indicated points to the cause of this, *viz.*, defective fermentation:—

	Cloudberry.	*Cranberry.*
Specific gravity	1·04	1·03
Extract	1·12 p.c.	1·04 p.c
Ash	·13	·15
Alcohol	1·15	·80
Sugar	6·15	5·10
Acid	·80	1·20
Tannin	——	traces.

Samples of currant wine have been found to contain over 20 p.c. of alcohol, by measure; gooseberry and orange nearly 12 p. c., elder 9 p. c., cyder 10 p. c., and perry nearly 8 p. c. With the exception of currant, these amounts are scarcely sufficient to keep them, but the standard may be increased, as already pointed out, by the addition of glucose.

Turning to India, the wonder is that we are not familiar with pine wine, tipari, and mango wine, and a host of others. Tipari fruit yields almost its own weight of juice, which on fermentation results in a delicious amber-coloured wine containing over 7 p. c. alcohol.

The amounts of sugar contained in the various fruits mentioned in this notice indicate the probable alcoholic value of their products. The apple and the pear contain of grape-sugar 6·7 p. c., increasing if the fruit is allowed to ripen. The orange contains 5 p. c., bilberry nearly 6 p. c., strawberry 4·5 to 7·5 p. c., mulberry and blackberry 9 p. c., raspberry 3·5 to 5 p. c. nearly, gooseberries and currants 7 p. c., plum 3·5 to 6 p. c., cherries 10 to 13 p. c., juniper berries 30 p. c., figs 48, dates 57, and the grape about 12 per cent. The more sugar the fruit contains, the richer will their wines be in alcohol. Some varieties of the plantain contain nearly 6 per cent inverted, and 16 per cent crystallisable sugar, the former increasing day by day at the expense of the latter, as the fruit passes from a state of sound to sleepy ripeness. This latter fruit is therefore not only well adapted for the manufacture of wine, or pure spirit, but for the manufacture of sugar, and could be used with advantage for increasing the alcoholic power of wines from fruits containing little sugar. The date and the fig, it will be seen, contain nearly half their weight of sugar; their value in wine manufacture will therefore be obvious. We are in want of exact information regarding the constituents of the mango, but we do not doubt that it contains a large quantity of sugar, and that a wine prepared from it would find much favour among the natives, who look upon the fruit as incomparable. The litchi and rose-apple would also we think repay experiment.

The amount of sugar contained in the nectar of many flowers warrants the presumption that a little perseverance would place us in possession of a series of wines or liqueurs of a very luscious nature. Fuschia and red clover give nearly 8 millegrams of sugar per flower, nearly 6 of which in the red clover is grape-sugar, and as we ascend the scale to flowers having fleshy petals, there is a proportionate increase. An important feature in flower wines would be their medicinal value. Cowslip wine and poppy-flower wine are pleasant soporifics; and orange flowers are said to possess certain sedative and hypnotic virtues, the water prepared from them being used in the south of France to counteract the sleeplessness that tea is apt to cause with nervous persons. The honeysuckle we know to be antiasthmatic. It therefore is not unreasonable to infer from the very pronounced medicinal characteristics of known flower wines, that all flowers capable of furnishing such, will possess the characteristic features of the plants yielding them. We may therefore look forward to the time when all remedies will come direct from nature's own laboratory in the form of fragrant and agreeable wines. How does this idea, we wonder, suit homœopathy?

The flower of the mahwah tree (India) contains much sugar, and yields, besides a pleasant wine, a very intoxicating spirit; the latter, according to Major Drury, resembling, if carefully distilled, good Irish whiskey. The flowers are said to be exported from Bombay to France. A full-grown tree yields about 20 cwt. The central bud of the agave, an acclimatised plant, introduced by the Portuguese into India, yields a sour liquid which readilly ferments, furnishing a strong alcoholic liquor. The plant possesses certain well defined curative properties, which, if possessed to any extent by the flower, would render agave wine an article of much value. A Tamil poet of times gone bye sung in praise of the palmyra, a plant applied for eighty-eight purposes. The flowering spathes of this plant yield a saccharine juice (palmyra toddy), from which an intoxicating liquor is made, and largely used by the common people. Wine and sugar are also made from the sap of the trunk. The flowers of many other palms, notably the cocoa palm, are replete with sugar, and yield on fermentation excellent wines, and by distillation the spirit called arrack. Arrack is looked upon by many people as a very crude spirit. We submit that, were it subjected to the same elaborate distillative treatment as whiskey, it would vie with that fluid in purity. From the foregoing, it will be seen that the subject of the fermentation of fruits and flowers is, by reason of its being allied to things we know, easy of pursuit, and that pursuit of it might result in the foundation of a new and profitable industry.

It is likewise self-evident that the inauguration of such an industry will, next to the introduction of pure grape wines from hitherto undeveloped sources, do more than anything else to drive from commerce those high priced and elegantly got-up shams so frequently met with: which, instead of *exhilarating* as pure wine invariably does, gives birth to feelings quite foreign to many whose bad fortune it is to have such administered to them, or foisted upon them; and which, when frequently indulged in, sap the vigour of youth, render old men idiotic, women feeble, the uneducated rebellious, and the rebellious murderous. Here in the East, where there is much in all conscience to enervate, depress, and render life miserable it does seem hard that life's luxuries, those stimulants on which life often depends during sickness, should be sold without restriction of any kinds; that palpably bad stock, seventy-five per cent of which are doubtless unreal, should be passed into commerce through H. M. Customs.

AGRICULTURE IN INDIA.

THE success of Baboo Ambica Charan Sen, M.A., Mr. Ozonne, the Director of the new Agricultural Department in Bombay, and of Syud Sakhawut Hossein, B.A., in obtaining the three first places at the Royal Agricultural College of Cirencester is suggestive. The Cirencester scholarships created by Sir Ashley Eden in 1880 will, in time, supply Bengal with a number of young men educated in the highest scientific school of agriculture in England. At home it is generally found that such men cannot earn a living as farmers, and there is little reason to expect better results in India, a country to which the principles taught in English schools have not been applied by direct experiments, and where land is cultivated in small holdings. They will, therefore, seek Government service, and no doubt will be employed, first as the managers of Government estates and of experimental farms, then as heads or members of agricultural departments in the different provinces. The Bengal Government is now commencing such management in one district, and there can be small question as to the tendency of the administration in that direction.

That Government may do a good deal for agriculture in this country is proved by the introduction of tea cultivation, which was the result of a State experiment, and the naturalisation of the cinchona plant, which now supplies, from Government estates, such a valuable febrifuge. On the other hand, all the Government studs proved failures, including that for mules at Darjeeling, in which there has never been a foal, and the model farms opened by Sir George Campbell had to be closed. The farm at Arrah caused a loss of ten thousand rupees in two years on thirty acres, cultivating ordinary country produce, or about the total value of the land in fee-simple each year. The building was afterwards given for a *domes'* school, while the land of a similar farm at Arrah were assigned to a billiard-club. For managing a farm, Government agency is deficient in two respects, either of which would be fatal. In the first place, the management is conducted on *doctrinaire* principles, which experience shows never pay, until so thoroughly adapted to the circumstances that they cease to be *doctrinaire*. In the second place, there is not the same incentive to gain which a private farmer has, the [illegible] anxiety to buy cheap and sell dear, to get workmen at the lowest wages, and exact the severest tasks from them and

to make petty savings in every direction. In thrift, in empiric skill, and in exacting labour, Government must always be inferior to the ordinary farmer. On the other hand, it can try experiments which no private person would undertake, because the cost would fall on him, and the benefit go to others.

We hope that in future some considerable portion of the attention of Government will be directed rather to the model management of estates, than to model farms, and to the latter mainly in connexion with, and as a means to, the former. Government is in every district of Bengal landlord, large tracts of land being its own property while it has to manage considerable estates for others. The position is one which it actually occupies, and the only question is as to how it will fulfil its duties.

On the other hand, Government is not at present a farmer, and need not be, unless it wishes. It is now pretty generally acknowledged that the past management of Government estates has been exceedingly bad. No improvements worthy of the name have been executed, the tenants have received neither aid nor direction, and the assessment of rent has been made according to the custom of the private zemindars of the district, and has therefore been excessive wherever these were extortionate. To keep the cheapest establishment for rent-collecting purposes, to keep no establishment for any other purpose, to get in the whole of the rent, and from time to time to raise the rent, have been the sole objects of Government. There is now, we are glad to observe, a change, though as yet it has borne little fruit, and we hope that the Cirencester scholars may be made the agents of future reform. They may be appointed to look after the larger Government estates, and set an example to private land-owners of what good management can do. Their knowledge of scientific agriculture would enable them to give the best advice to the ryots, which the special knowledge of the latter would enable them to apply. Among the improvements which they might effect we may mention draining, the storage of water against droughts, the introduction of improved plough-oxen by utilising better bulls, the improvement of the breed of ponies by getting better stallions, the planting of fuel reserves, the preservation of pasture commons from the encroachments of the plough, the procuring of better seed, the spreading of knowledge of the method of raising the more valuable crops, the supply of such approved agricultural instruments as of the Behoea mills, the protection of ryots from the extortion of money-lenders and the purchasers of produce, where such is needed, the encouragement of combinations for all useful purposes, the erection of primary schools, the making of roads, and the reformation of village conservancy. If trained Government officials set an example of such work on the Crown lands, the zemindars would be glad to imitate. At present Government preaches in favour of a zealous performance of the duties of a landlord, because every native zemindar can see how Government performs them.

A home farm ordinarily is a part of a system of good management of an estate, and it would be as useful in India, as elsewhere. But to be really a model, it must resemble the ryots' holdings in size. When Sir George Campbell made an attempt in this direction, Mr. Hume declared that a Government farm, to be a success, must extend over at least a thousand acres. Now we hope that nothing of this kind will be attempted. If it were successful, it would show zemindars how ryots might be evicted wholesale at a profit, and the income of one man improved by the ruin of thousands. Government might just as wisely establish a model school for house-breaking, with specimens of the newest Bill Sykes' tools and weapons. A thousand acres of land for a model farm can be obtained in Bengal only by evicting two hundred families, most of which may starve, and this is a price not to be paid for an experiment, which would, after all, be only for the advantage of those willing to imitate the crime of wholesale eviction. In small quantities land can be got on Government estates, and experiments tried suitable to the system of *petite culture* which prevails in the country. But it should be understood that such experiments form but a part, and a small part, of the general system of model management, to introduce which should be the object of an Agricultural Department.

EDITORIAL NOTES.

A CORRESPONDENT of the *Rural New Yorker* says :—"The whole poultry business, as managed by dealers in fancy poultry, is a delusion and a snare to any one who enters the business with the expectation of making a legitimate income from it. In their case the value of a fowl is not determined by the eggs or pounds of poultry produced, but the bird is 'scaled' by the size and shape of comb, color of feathers, style of tail, and similar nonsensical points. Let the farmer try a similar method in determining the value of the cows he buys, and how long will he be able to make dairying pay? Why is it not just as wise to purchase a cow for the color of her nose, the style of her horns, the color of her hair and the make-up of her tail, as to pay a fancy or absurd price for similar qualities in a hen."

IN an interesting paper read before the Society of Arts, on "English Goods and Chinese Buyers," by Lieutenant the Hon. H.N. Shore, R.N., the following passage occurs :—But the article of foreign commerce which threatens to distance all other competitors in point of popularity is kerosene oil. The development of the trade in this article has been remarkable of late. It is entirely supplanting the native bean and tea-oil, which has done duty hitherto for lighting purposes, and may be truly described as supplying a want long felt, Chinese social economy being sadly deficient in good house lights. The cheapness and brilliancy of the oil in burning makes it a great favourite. It has found its way to the most distant parts of the empire ; nearly all shops are lit by it, and for hundreds of miles round many of the ports opened to foreign trade, almost every cottage will be found with its small tin lamp of native make for burning the oil. Its cheapness has had a somewhat undesirable result in Shanghai, so far as shareholders in the gas company are concerned, having prevented gas from coming into general use amongst the natives, who, it is stated, prefer to buy their oil in small quantities as they want it, instead of running up gas bills without any satisfactory check on household expenditure.

The oil is at present almost entirely supplied from the factories at Philadelphia, and the trade is practically a monopoly. From the high popularity it enjoys, there is every reason to suppose that, until the petroleum wells which are known to exist in China are opened up, the importation of the foreign article will continue to increase for many years to come. The extent of this increase may be gathered from the following returns :—at Hankow, the imports rose from 27,976 gallons in 1877, to 285,157 gallons in 1880 ; at Wu-hu, from 2,190 gallons to 71,110 gallons during the same period ; while the returns for Shanghai show that, in 1879, the importation reached the prodigious total of 4,780,440 gallons.

THE Boston *Commercial Bulletin* prophesies that a large source of wealth for the Southern States is in their timber. In New England, the timber supply, it says, is already exhausted ; so of the hard woods in Indiana and Ohio, while the pine forests in Wisconsin and Michigan are being rapidly denuded. In this dilemma the lumbermen are turning longing eyes upon the southern woodlands.

THE *American Chemical Review*, in its latest issue, gives the following description of the use of sulphite of magnesia as a defecating agent in sugar works :—This invention substantially consists in operating the defecation by means of basic sulphite of magnesium, which is used either alone or previous to any addition to the liquor of caustic lime or other strong bases apt to decompose organic matter ; and the object of the invention is to produce in the liquor alkaline sulphites and insoluble magnesic salts and to coagulate albuminous substances, while the formation of soluble calcic salts and of caustic alkalies is avoided as much as possible. At the same time the liquor is decolorized to a great extent.

The process may be carried out in different manners. One method of proceeding is as follows :—Sulphite or bisulphite of

magnesium and caustic magnesia are mixed together in water in such proportions, that the compound thereby formed will show basic reaction, and of this compound a sufficient quantity is added to the liquor at a temperature adapted to the quality of liquor and to the quantity of foreign matter contained therein. The said sulphite or bisulphite of magnesium and caustic magnesia may be such as form articles of commerce. Instead, however, of combining these substances as described, sulphurous acid may be introduced either in liquid or in gaseous state into cautic magnesia, stirred up in water, so much acid being added as is necessary to impart to the solution the required basic character. With this process hyposulphurous acid and trithionic acid may be formed; but this is of no consequence. In case too much acid should have been used, caustic magnesia is subsequently added in the proper quantity.

The second mode of proceeding consists in producing the basic sulphite of magnesium in the saccharine solution, by separately adding to the same the requisite quantity of caustic magnesia and sulphuric acid, or sulphite or bisulphite of magnesium. Instead of caustic magnesia, a magnesium salt, which is decomposed by sulphurous acid, may in either case be employed. The defecating medium having been well mixed with the liquor, which at the time of mixing may be warm or cold, the latter is heated or maintained in the heated state until the solid matter has separated out and the liquor has become clear. In case a complete separation should not yet ensue, so much more caustic magnesia is added as is required to produce the desired effect.

It will generally be found advantageous to subject the liquor, after it has been filtered off from the sediment produced, to a subsequent treatment by lime, baryta, or strontia, or by the hydrates or the saccharates or the aluminates thereof, for the purpose of decomposing such of the sulphites formed as are acted upon by the said substances, and of precipitating any magnesia which may have been dissolved.

In case any of the substances named should have been added in excess, such excess may be neutralized wholly or partly by means of carbonic or sulphurous acid, or of both combined, or by the use of any other known and suitable precipitating medium.

From the sediment produced by the defecating process, the magnesium sulphite and the caustic magnesia may be recovered by means of known chemical processes. Moreover, the ammonia and other nitrogenous compounds contained in the sediment may be extracted therefrom either in the same process or by a separate treatment.

The inventor is aware of the fact that acid sulphite of magnesia has been proposed as a defecating agent, but the use of basic sulphite, as devised in his patent (U.S. Pat. 268,987), he claims, is new and different in its action. The claims made in connection with this patent are as follow :—

The method of defecating saccharine liquors, which consists in adding to or forming in the liquor basic sulphite of magnesium, and, if required, in subsequently adding caustic magnesia, the process being carried out previous to the aforesaid treatment of the liquor by lime or other strong bases, substantially as and for the purpose described.

In combination with the method of defecating saccharine liquors by means of basic sulphite of magnesium and caustic magnesia, as described, the subsequent treatment of the liquor by lime, baryta, or strontia, or the hydrates, the saccharates, or the aluminates thereof, substantially as herein specified.

In combination with the method of defecating saccharine liquors, as hereinbefore claimed, the employment of carbonic acid, or sulphurous acid, or any other known and suitable precipitating medium, for the purpose of partly or entirely preciptating any bases added in excess.

BELGIUM, says a correspondent, is the most carefully and elaborately-cultivated country in Europe, and the Belgian farmers raise larger crops per acre in their small, unfenced, and finely-lined farms than are raised anywhere else. Farming there partakes of the nature of gardening : indeed, it would be called gardening elsewhere. Wheat is the important crop, and the management of it is particular to what other people would call an extreme. The seed is sown in the fall—spread broadcast and thick over rich and well-prepared plant-beds, similar to those which Missouri tobacco-raisers prepare for their tobacco seed. The young wheat comes up thick, rank and strong in the fall, and remains so all winter, forming a mat on the ground. In the spring the ground is thoroughly prepared by deep ploughing and harrowing, after which it is marked off in drills ten inches to one foot apart, one way. The wheat plants are then pulled up from the bed in bunches and carefully picked apart, one at a time, and dropped at distances of four to six inches in the drills in the field. After the dropper follows the planter, who, with a trowel or thin paddle, makes holes in the drills at the proper distances, and sets out the separate plants in the same manner as strawberry, tomato, or tobacco plants are set out. When the work is done there is a wheat field planted in drills one foot apart, and with the plants six inches apart in the drills. It is a tedious and particular process. But on the small five-acre Belgian farms, worth $200 to $500 an acre, it amply pays for the trouble. The Belgian wheat fields, after being planted, are carefully cultivated between the rows by hand until the plants are too high to admit of further work. The plants branch into stools from each of which shoots up stalks bearing heavy heads of grain ; and when the harvest comes, the yield is 100 to 150 bushels of grain to the acre.

A CORRESPONDENT writes :—The diminishing supply of good foreign tobacco has forced the French Government to consider the question of its home cultivation. For three years experiments in the south-western portions of the country have been carried on ; the results have exceeded the most sanguine hopes. Last year despite the cold, wet season, the yield of tobacco was so satisfactory, that an important area of land is at present devoted to tobacco, soils of a sandy character being preferred, such being the kind on which the best brands of Havana are raised. Climate does not seem to be the decisive factor in tobacco culture. In the West Indies, tobacco is cultivated during the winter season, that which signifies a temperature equal to the summer heat at Bordeaux.

The culture of tobacco can replace the destroyed vineyards, and another consolation has been found in the cultivation of China grass or ramie. The great obstacle, up to the present against the latter, has been the want of a machine to bark or skutch the stems, and set the fibre free, cleanly. Such is claimed at last to be found, as a company has been organized not only to construct the machines, but to hire them out to the farmers : further, the company in question guarantees to supply seed and plants at reduced rates, and to take all the grass raised.

THE following is from the *Colonies and India* :—Within the last twenty years a vast extension of the economic uses to which this valuable fibre [cocoa-nut fibre] is put has taken place. The term "coir," usually applied to this material, is the Anglicised form of the South Indian "kayaru," cord or twine, and is not applied in India to the raw fibre, which is called in the Tamil language "savuri." The fibrous husk or rind of the cocoa-nut is easily stripped from the nut while yet green, by striking it on the point of an iron spike, and then is steeped in salt or brackish water, where it lies for several months, until the softer portions of the husk rot away, and the strong fibre alone remains. This is taken out, beaten with a stick to separate and clean the fibre, and twisted with the required number of strands into rope, or woven into matting, while the stiffer fibres are made into brushes and other articles of domestic utility. The fibre is pressed for shipping into bales, weighing 200 lbs. each. The attempt has been made to prepare the fibre from the dried husk in England, but without success.

Much of the coir fibre used in England is brought from Ceylon ; but a large and increasing quantity is now exported from Bombay and the Western Coast of India. The supply is not inexhaustible ; but as prices rise, cultivation is encouraged, and as the growth of this palm is along the sea coast, where other crops cannot be grown, the trade is a profitable one.

Factories for the weaving of coir matting have been opened by English and American firms at Aleppy, Quilon, Colachel,

Cochin, &c., and turn out a considerable quantity of goods. Spinning is not attempted here, being more cheaply done by hand at the places where the fibre is produced. Along the coasts of the backwaters and canals, many people may now be busily engaged in scraping and cleaning the fibre and twisting it into yarn. In the factories the yarn is first sorted to its various shades and qualities. The warp is made by boys running backwards and forwards; then it is flattened and smoothed for weaving by being run through heavy rollers. The weaving is laborious work, performed by men, who earn two or three rupees a week at it. The web is again rolled to give it some finish, wound securely in a roll, and marked.

Large profits have been made in this manufacture in India. But it can now be carried on so much better in England, with the machinery and appliances available here, that large quantities of the yarn are exported. One firm in Lancashire have introduced steam loom weaving of this material. The various shades of fibre—cream-colroured, reddish brown, and blackish—which vary greatly according to care and skill in preparation, are first carefully separated, and cocoa-nut matting is now made of fine quality with pretty shades of colour and in pleasing patterns, so as to be available for higher uses than the very coarse makes, and the material is most durable. The yarn is also plaited by machinery into cinnet or belting.

Cables made of coir bear exposure to salt-water better than anything else, the tannin which it contains preventing the fibre from rotting; they are exceedingly light and buoyant, as well as elastic. Coir cordage, in Dr. Wright's experiments, broke at 224 lbs. weight. Even the refuse and broken fibre can be turned to account for stuffing mattresses, and is used in horticulture, &c., as no insect will touch it.

The exports from Travancore of this material form a large proportion of the trade of the district, and amounted, in 1879-80, to nearly 150,000 cwt., valued at 13¾ lacs of rupees (say £137,290), and paying to the Government a duty of 68,000 rupees. Of the cocoa-nuts themselves, nearly 9,000,000, valued at nearly 2,60,900 rupees, and paying customs duty 13,000 rupees, were sent away. Other products of this palm exported as oil and copra or dried kernel, were valued, the former at 3,22,100 rupees, and the latter at no less than 26½ lacs of rupees, making a total value of the export of products of the cocoa-nut palm, from Travancore alone, of 46½ lacs of rupees (nearly half-a-million sterling). Some thousands of tons are also exported from Cochin.

Cocoa-nut fibre is so durable, useful, and economical a material that a great future is assured for the industry; and, as prices rise, the natives will pay increasing attention to the collection of the whole amount produced, and to its careful preparation. Perhaps, when, through increasing demand, the fibre becomes still more expensive, it may be found possible to prepare it of greatly improved quality and appearance by steaming or boiling so as to avoid the pollution of ponds and backwaters by the decomposing pulp of the husk, and the consequent blackening of the fibre so often observed. The textile ingenuity of the present age of invention may perhaps devise some additional uses for this fibre; hats and bonnets made of this material have, it is said, attracted much attention.

A correspondent of the *North British Agriculturist* has the following note on the application of nitrate of soda:—Regarding the most economical use of 'nitrate of soda,' I find that much depends on the nature of the soil to which the manure is to be applied. A clay soil or a soil containing upwards of 50 per cent of clay is capable of retaining fertilizing matter that may be applied to it until the crop is able to make use of it. In such a case nitrate of soda could be safely applied under either condition. Such does not apply, however, to light soils or such as contain only a small percentage of clay; these soils are, generally speaking, minus a class of bodies known in chemistry as 'double silicates,' or at least do not contain them to any great extent. These 'double silicates' are composed of the 'silicate of alumina,' part of the 'alumina' being displaced by an equivalent of soda, lime, potash, ammonia, as the case may be. It is these bodies, then, that give to a soil power to hold fertilizing matter for the use of crops.

On light soils where there is a possibility of these bodies not being present in the required strength, nitrate of soda or any other rapidly soluble manure should never be applied, till there was active vegetation to make use of it as it is dissolved, and in such a case it would be nonsense to talk of sowing nitrate of soda on a wet day or during wet weather, for thereby it would dissolve rapidly in the rain, with it be carried down through the soil to the drain pipe, and be lost.

It is not precisely known, says a contemporary, from what period the cultivation of hemp in Anjou dates, but it is recorded that in 1748, the Joubert family established, by royal permission, a sail-cloth factory at Beaufort-en-Vallée, which was afterwards transferred to Angers, where it still exists. In 1752, the brothers Danton obtained the privilege of founding at Angers the manufacture of printed goods, but this industry seems to have failed to establish itself permanently in the district. There are (according to the *Moniteur des Fils et Tissus*) several important houses at Angers engaged in the hemp industry, whose products are favourably known in other countries.

Within the last thirty years wages have considerably increased in the Angers district, the augmentation being about 25 to 30 per cent for spinners and other operatives engaged in the earlier stages of manufacture, while weavers are receiving double the wages they were getting in 1850. The introduction of power-looms has increased the quantity produced, thus allowing of an augmented remuneration to the workpeople engaged in this branch of manufacture. The general condition of the operatives is far more comfortable than was formerly the case. This result is due in a great measure to the spread of economical habits amongst the working population. In one factory every workman, who saves 100 francs during a year out of his wages, receives from the firm 15 francs as interest. This harmony of feeling between employer and employed allows of industrial changes being carried out when necessary, without the difficulties arising which are often met with where a less friendly tone prevails.

A German chemist, Herr Maximilian Zingler, has just patented, it seems, a new process for manufacturing a substitute for gutta percha. About 56 kilos of powdered copal and 7½ to 15 kilos of sublimed sulphur are mixed with about double the quantity of oil of turpentine, or with 55 to 60 litres of petroleum, and heated in a boiler provided with a stirring apparatus to a temperature of 122 degs. to 150 degs. C., and stirred until completely dissolved. The mass is then allowed to cool to 38 degs. C., and is then mixed with about three kilos of casein in weak ammonia water, to which a little alcohol and wood spirit has been added. The mass is then heated to the former temperature (122 degs, to 150 degs. C.) until it is a thin fluid. It is then boiled with a 15 to 25 per cent solution of nutgall or catechu, to which about half a kilo of ammonia has been added. After boiling for several hours the mass is cooled off, washed in cold water, kneaded in hot water, then rolled out and dried. It is claimed that the resultant product is much cheaper and cannot be detected from the real article. It is said to wear equally as well.

Hoshiarpore is one of the largest sugar-producing districts in the province. The cane is there grown almost entirely on *barani* or unirrigated land, and to many a village is a source of great prosperity and wealth. It is a wonderful sight to see in January or February the great plain of the land, about 10 or 12 miles south of Hoshiarpore on the way to Jullundur, covered with 100 ploughs busily working to prepare the soil for the reception of the (so-called) seed.

The process of manufacturing is as follows:—

The juice, *ras*, is boiled till it is thick; when being boiled, it is cleared with the mucilage of the bark of one of two hill trees *pula kydia calycina* or *bahal* (*grewia* ?). The mucilage, when prepared for use, is called *suglai*; after the juice has been thickened by boiling, it is called *rāb*. Out of the *rāb* is pressed the molasses or *shira*, being strained through a bag made of coarse blanket. *Shira* is worth at Hoshiarpore nearly Rs. 2 per cwt. After the pressing operation is over the

remaining mass, red in colour, is laid in large wicker troughs called *khanah*, and covered with a thick layer of water weed, *jhala*. There are two species used, *bhātu* and *kareli*. They are, I believe, species of *Vallisneria* (Apiralis ?) or *Potamogeton*, but I have not succeeded in identifying them. As the layer of weed ferments, the sugar turns white, when it is taken off. A fresh layer of the weed is put on during three days for some weeks (in Sirmoor from commencement of *Chet* to end of *Baisakh*). Sometimes the sugar-cane crop is much injured by frost, and this is of course a great calamity to the district. I recollected one year, 1880, great damage was thus done. In Gharmaur (Pergunnah Garhshankar) the people sold their cane for seed at about Rs. 140 per acre of standing cane. This they found at that time more profitable than to press it, for the juice would not have brought in more than Rs. 60 to 90 per acre.

If the soil is too dry, the frost is said to be hurtful to sugar-cane : the soil of the Serwal tracts in the south of the Hoshiar-pore District is said to be good for cane on account of the moisture it contains which enables the cane to stand the frost.

In Hoshiarpore the varieties are—

Dhaulu.
Chann.
Kanara.
Ekar.

Dhaulu and *Chann* are the varieties most commonly cultivated in the Serval, I believe. *Dhaulu* is said to be the richest in juice, and if a certain quantity of juice has been contracted for, *Dhaulu* would be the kind cultivated to meet the contract.

Chann, however, is a better cane, giving more sugar. So if the produce is for home use *chann* is preferred to *dhaulu*.

Ekar is the variety most cultivated in the hills. It is said to be hard and harsh-tasted, and wild pigs do not attack it when full grown : a great advantage to the hill tracts.

Kanara is cultivated here and there, mixed up with other kinds. It is very soft and suitable for chewing.

In appearance the four kinds may be distinguished as follows :—

Dhaulu, light green stem.

Ekar also light green, but has black longitudinal lines or splits in each joint or *pori*.

Chann is thicker, with brown or purple patches of bloom on the lower joints.

Kanara is thin with short joints, very sweet, and soft *like silk*.

A CORRESPONDENT of a contemporary has the following on the coffee grub :—

With grub, as with leaf-disease, only some drastic application for their utter extirpation once and for ever was considered worthy of a fair trial. Similarly as with the fungus, I contend that we have unwittingly fostered the insect by a system of applying manure which obtained some ten years since, and also by the nature of the fertilizers themselves. The soil on being slackened up immediately round the stem of the tree was scraped away by hand, in order that as few roots as possible might be disturbed, and cocoanut poonac and castor cake were spread in the hollow thus made and covered up with earth, thereby forming a soft mound into which the beetle, with no difficulty, burrowed for the depositing of its eggs. Here were all the conditions essential to grub life. The soil was undisturbed by coolies working amongst the coffee ; incubation went on apace ; sufficient sunheat reaching the spot through the centre of the tree, which is always kept handled out. The grubs, on reaching that stage, found they were indeed in a bed of roses : turn where they would cocoanut and castor cake were in abundance ; not only that, but a mass of tender rootlets were ready for their operations. Small chance of a single egg or larva perishing here, and little wonder that the tree rapidly shed its leaves ; but a short space of time was necessary to deprive it of every feeding rootlet. Ever since there was a coffee estate there has been grub, but not to the extent we have it now, and if we are to reduce their numbers we shall only succeed by rendering their conditions of existence hard. This can be accomplished by applications of fertilizers obnoxious to the insect, dug broadcast into the soil. In spreading the manure over a larger area, we not only induce a larger root surface, but we reduce the chances of every rootlet being reached and make grub life harder.

From constant communication with the Entomologist for the Royal Agricultural Society of England, and through experiments carefully conducted here, I have come to the conclusion that rape cake, in which mustard seed forms a considerable proportion, is a remedy as well as a valuable manure, for I have found it is the only substance of the kind that they cannot exist on. Castor and cocoanut cake they seem thoroughly to enjoy.

Miss Ormerod found that forty-eight hours' confinement in rape cake kept moist was sufficient to kill wire-worm outright. This ought to be encouragement to those who are continually looking for specifics to give rape cake a fair trial. In case of disappointment, however, I should advise those who purpose experimenting to be careful that they procure the cake I mention, as I understand pure rape is shipped from many parts of India, into the composition of which no mustard seed enters. Manures in the manufacture of which sulphuric acid is used, such as dissolved bones and superphosphate of lime, are also very offensive to grub.

The only antitode with which I am acquainted and which at the same time is innocuous to the roots of plants, is powdered mustard, but my experiments with it scarcely warrant me in stating that the quantity used, to be effective, would be practicable, owing to its cost. Later on, I shall be glad to communicate the result of my experience.

I may mention that on my attention being directed to the use of mustard seed by hop farmers in some parts of England, as a remedy for wire-worm, I procured a few bushels, which have had the most satisfactory results in expelling the insect from the soil on which it was sown broadcast, and mulched in green before it reproduced seed.—DIOGENES.

A CORRESPONDENT of the *Madras Mail* writes :—

The financial results of the manufacture of poudrette by the Municipality of Adoni, which you noticed in your issue of the 7th instant, is not well calculated to induce more Municipalities to adopt that system of disposing of the night soil. The manufacture of poudrette has successfully solved the much-contested question of removing the night soil and street sweepings in a manner thoroughly efficient, and their subsequent utilisation as a manure. I would that a voice were raised, feeble as it may be, in favour of its manufacture, in a more extended form, by other Municipalities in Southern India. Its advantage, over other modes of disposing of excrementitious matter, may be considered under the heads of sanitation and economy. The practice of many of the Municipalities as regards the night-soil is to cart it to some place beyond the limits of the town, and there deposit it in deep pits excavated for the purpose, or what is worse to spread it out over existing swampy hollows. Here decomposition sets in, worms and maggots are generated, and the nuisance caused by a stuff that is naturally foul is aggravated a thousandfold ; and it continues in this state of putrefaction for months together. But the process of manufacturing poudrette does not occupy more than five days, and even in the rainy season it hardly exceeds ten days. The material manufactured is as harmless and inoffensive as dry earth. It is also the most economical way of removing the night-soil. The deodoriser used in its manufacture so completely and within a few minutes covers up the noxious smell and removes its injurious effects, that neither the eye nor the nose can perceive anything offensive For this reason it may not be necessary to have the poudrette depôt very far removed from human habitations. But when night-soil is wastefully thrown away in deep pits to putrefy there, contaminate the surrounding air, and endanger health, it is indispensably essential that the depôt should be as far from the town as possible. Now, in the manufacture of poudrette, the heaviest item of expenditure is cartage of the night-soil, which amounts to about three-fourths of the total cost. The actual process of converting this stuff into poudrette costing a mere iota. Thus the cartage for the extra distance entails heavy expenditure, and runs up to more than the

cost of manufacturing poudrette, which is the cheapest method of disposing of the night-soil, immaterial of any profit, that might accrue from its sale. The advantages of poudrette do not stop here. They are elastic, and must expand in course of time. When the merits of this material come to be duly acknowledged, and when the deeply-cherished prejudices of the native cultivators have worn away, the financial results will present quite a different aspect. A few facts will be more effective than a whole string of arguments, and it would be better to cite a few. The report on the working of the Poona Municipal Poudrette Depôt, and its financial results, for the year 1882, are as startling as they are satisfactory. It is interesting to note how reluctant the agriculturists were to use poudrette at the outset, and how its worth, as a manure, gradually rose in their estimation before the happy results of the year under review were achieved. The amount realised by the sale of poudrette in 1875 was Rs. 766, while the cost of manufacture was about Rs. 18,000. In seven years the demand for this stuff rose so much, and the competitions at the sales become so keen that in 1882 the proceeds from the sale poudrette rose to Rs. 30,776, while the cost was only Rs. 19,684, showing a net profit of Rs. 11,092. The report says: "Seven years ago agriculturists would not touch poudrette thus prepared, and could not be induced to take it away even at a nominal charge. At present the out-turn of the manure is not enough to keep pace with the demand. Poudrette is now sought for from a distance of twelve miles, and in one case it was taken to a distance of twenty-four miles for an orange plantation." Cannot the local Municipality be induced to make an experiment with poudrette even on the smallest scale? The collection and removal of the night-soil to the various depôts set apart for it, costs our Municipality two lakhs of rupees annually. This is about one-fourth of the total Municipal revenue. The quantity of night-soil collected in this city may be estimated at 30,000 tons a year. This, added to the deodorising material used, will yield 60,000 tons of poudrette. Taking Rs. 5 per ton as a very low price of poudrette, the revenue derived from its sale will be three lakhs of rupees. The expenditure will be only a trifle in addition to the two lakhs which the Municipality spends annually. It is very gratifying to reflect that the revenue of our Municipality can be enhanced by three lakhs of rupees annually, within a period of six or seven years, and that, too, without any extra burden on the rate-payers of this poor city, who are already groaning under a not overmuch taxation. This may look like a dream too beautiful to be realised, but have we not the experience of Municipalities like that of Poona, pointing to the feasibility of earning a net revenue from a system which in bygone years cost an enormous outlay without any profit?

Another correspondent says :—

I read with much interest the admirable communication in your paper of the 11th instant, touching poudrette as a manure. I agree with all your correspondent advocates, and I think there cannot be two opinions of the superiority of disposing of our night-soil by manufacturing it into poudrette over the old, and what should now be the obsolete custom of carting it away and burying it in pits. But your correspondent goes on to say, if I mistake not, '*it is the most economical way of disposing of the night soil.*' Is that so? Has that been satisfactorily worked out? Because, if so, I do not see why all Municipalities should not convert night-soil into poudrette; for undoubtedly it is a cleaner and more efficacious way. If he means only, it is a more economical way *if the poudrette can be sold*, I am afraid he is leaning on a broken reed. The people of Southern India are intensely prejudiced on this head. I know of no place where the people will use poudrette. At Bellary you may see, a little way out of the town, a magnificent mound of this invaluable fructifier, but not a farmer can be induced to try it, although the municipality have offered, I believe, to give a large quantity away for nothing, if ryots will only remove it. In fact the use of poudrette is, I take it, one of the most important problems we have to work out. If, as in Poona, cultivators could only be induced to use it, most Municipalities would reap an income which would materially lessen taxation, but Ramsawmy obstinately refuses, and what is to be done? Government might, perhaps, do something, though it is not very evident what. The most curious thing is, that cultivators have no objection to seeing their fields near towns and villages used as places of resort by the community, and I presume must recognise that their fields thus used are benefitted, but they obstinately refuse to have recourse to the more cleanly and efficacious means modern science places at their disposal. We must wait patiently for some enlightened man to arise and instruct his fellow-countrymen. Mr. Sabapathy Iyer, at Bellary, is doing his best, and is at present the Mochi of his day.

The Mexican Government has concluded a contract with Mr. Oscar A. Droege to plant two millions of trees in the valley of Mexico within four years, commencing March 15, 1884. Half-a-million trees a year are to be planted in such places as the Government shall decide. The contractor pledges himself to establish a number of nurseries, and to have in them each year at least 800,000 ash, 35,000 willows, 120,000 poplars, 60,000 eucalyptus trees, 60,000 troonos Japanes, 60,000 mountain cypress cedars, 60,000 acacias, and 120,000 of miscellaneous varieties. The trees must be in plantations of from 50,000 to 100,000 each, and Mr. Droege has to maintain them for two years after planting. He is not compelled to plant trees along the highways, however. Three graduates of the School of Agriculture are to be received into the nurseries each year, there to study the science of forestry. He is also to raise fruit and other useful plants for free distribution. There is to be translated from the German every year a work on arboriculture of recognised merit. An inspector is to superintend, and Mr. Droege is to receive annually 40,000 dols. till the sum reaches a total of 200,000 dols.

Experiments with Locusts' Eggs.—Some interesting experiments on locusts' eggs have lately come to our notice. One dismal fact has been discovered, *viz.*, that hatching and development will go on under what would ordinarily be considered most unfavourable circumstances. The egg, of a reddish brown colour, is about the size of a grain of wheat, but not quite so thick. A handful put into a tumbler mixed with earth and drenched several times a day with water continued to burst and send forth the young insect. A similar quantity mixed with dry earth in a finger glass and covered with green grass did likewise, with the only difference that those subjected to the periodical shower-bath were slower in hatching. Two or three eggs put into half a tumbler of water sank, but on the egg bursting to let out the young one it floated to the surface. This is certainly perseverance worthy a better cause—and must dispel the illusion that heavy rain would kill the locusts. It is curious to watch the convulsive struggles of the insect to free itself from the encumbrance of the shell. First appears the head, a moment's repose, and the whole insect bursts forth, lies perfectly inert for about a minute, and then a tiny green locust, unmistakeable from the peculiar formation of the head, complete, except that he is wingless, hops about as frisky as the proverbial frolicsome kid. Mr. Bor's theory for their destruction seems to consist in the interception by means of screens four feet high on young locusts in the crawling stage. It would be interesting to know at what perold of their existence they crawl. The writer has seen them five minutes old hop a foot. Efforts are being made in various collectorates for the collection and destruction of eggs. Many district officers, instead of enjoying at head-quarters the repose they have earned after eight months of the travelling season, are out in the districts after what is facetiously termed "locust shikar." Notwithstanding these most praiseworthy efforts, it is feared that unless nature steps in, much damage will be done to the young crops before they can be harvested.—*Bombay Catholic Examiner.*

The *Central Blatt für Textil Industrie* states that the superstitious views of the Buddhists had, until recently, prevented the extension of silkworm culture in Ceylon. According to the latest accounts, however, this opposition has been overcome, and silk is occupying much attention in several districts. The numerous insects and reptiles of the island have been found to render progress difficult; but it is expected that, by the adoption of such precautionary measures as are usual in

tropical countries, the new enterprise will finally be successful.

New York Industries.—According to the census returns of 1880, there were at that time in New York 378,159 men and 135,218 women, making together 513,377 persons, including servants of both sexes, who obtained their living by the work of their hands. The various branches of industry amounted to 218, giving employment to 146,179 men, 71,795 women, and 9,878 children under 16 years of age. The capital engaged in these trades was £36,200,000, the wages amounting to £19,400,000, and the raw material to £57,680,000. These 218 industries were carried on in 11,339 establishments, including 839 boot and shoe factories, 782 bakers' shops, 761 tobacco manufactories, 736 clothing works, 460 carpenters' shops, 412 printing offices, 401 plumbers' shops, 229 furniture warehouses, 293 painters' shops, 177 tin-ware factories, and 174 saddlers' shops. A capital of £14,000,000 is sunk in the manufacture of waterproof clothing, and £6,010,000 in the boot and shoe trade, which provides employment for 15,000 persons in 120 establishments. No less than 30,000 tons of raw india-rubber are imported annually into the United States. Combined with other substances, it produces a total weight of manufactured articles amounting to 300,000 tons. The cost of raw india-rubber four years ago was under 2s. a lb., but it has now risen to about 5s. In consequence of this great rise in the price of india-rubber, attempts are made to replace it by other substances, such as celluloid.

Institute of Agriculture.—The Council of this Institute, which has been founded for the purpose of advancing technical instruction upon various sections of agricultural practice, have issued their second annual report, from which it appears that the total number of persons to whom certificates of merit have been awarded, during the present session, is one hundred and three. The arrangements for the next session consist of a course of 280 lectures upon agricultural science, from October 1st to May 3rd, 1884; a course of 60 lectures on poultry, dairy, and bee management, from March 10th to May 3rd, 1884; a course of ten Monday evening lectures on agricultural science from February 18th to April 28th, 1884. Research committees have been established, and are carrying on their respective inquiries upon root crops, farm seeds, and plant growth. The address of the Institute is South Kensington, S.W.

Chinese Tea Trade.—The returns of the export of tea from China and Japan during the past season continue to show a great decline in the shipments to this country. In the twelve months ending the 31st May, the total consignments to us were in round numbers:—

	lbs.
1882-3	170,000,000
1881-2	164,000,000
1880-1	175,000,000

To the Continent the shipments were—9,360,000lbs. in 1882-3, as compared with 10,100,000lbs. in 1881-2, and 7,200,000lbs. in 1880-1. Accompanying this decline in the supplies of tea which Europe has obtained from China, there has been a large increase in the supplies from India, and the Indian product would thus appear to be gradually ousting that of China from our markets.

The number of cattle killed in the Madras Presidency by wild animals was, it seems, 9,703, against 8,938 in the preceding year. Nearly three-fourths of the number fell victims to tigers and panthers. The loss was particularly heavy in Cuddapah and South Canara. It was also large in Vizagapatam, Godavari, Kurnool, Salem, Madura, Tinnevelly, and Malabar. At the very moderate rate of Rs. 20 a-head, the 9,703 cattle destroyed by wild beasts represent a loss to the cultivator of about 2 lakhs of rupees, or between four and five times as much as the Government has expended in the destruction of these animals, and this loss is calculated to be annually recurrent, though readily terminable by the sanction of adequate rewards. Looking at the loss in Cuddapah 2,032, and South Canara 1,765, worth, respectively, Rs. 40,640 and Rs. 35,300 to the agriculturist, against Rs. 2,529-8-0 and Rs. 5,400 expended by Government, it would seem a retrograde policy to have reduced the rewards formerly sanctioned. In these districts, at least, where it is clear that the cultivators have had to pay for the maintenance of these wild beasts seventeen and six times, respectively, what the Government have laid out on their destruction, and have had to pay this much in cattle alone without taking note of their loss in sheep and goats, it would seem that the Government reward should be enhanced, and that the amounts suggested in Board's Proceedings in G.O., 4th March 1882, No. 261, are not excessive.

But apart from the three districts particularized as marked instances, the Board are of opinion that it is false economy to go on paying inadequate rewards for a series of years, allowing the agriculturist also the while to lie under unnecessary losses and difficulties, and that it will be much cheaper in the end to enhance the rewards as proposed in Board's Proceedings enclosed in G.O., 4th March 1882, No. 261, and press the destruction rapidly home. Large areas could then be perfectly freed by extermination, and the cultivators would be saved the additional cost to which they are now put of nightly fencing their cattle in tiger and panther proof structures.

Tin Ore in the Malay Peninsula.—It appears that in 1882 the exports of metallic tin from Perak amounted to no less than 7,000 tons, which equals the production of Cornwall; and about 40,000 Chinese are now engaged in mining works there. A French Company has been formed for working the deposits of tin ore in Malacca.

Information has been received from the Foreign Office, through the Science and Art Department, to the effect that the "International Exhibition of Machinery and Apparatus best adapted for the Extraction of Water for Irrigating and Cattle-watering Purpose," announced to be held at Cagliari, in May, has been postponed until November next. The machinery and apparatus admitted to the show are to be divided into the following classes:—Class 1. Boring apparatus of tubular wells furnished with the respective suction pumps. Class 2. Borers and exploring implements for the search of subterranean waters. Class 3. Water-wheels, chains, with buckets for raising water, turbines, centrifugal pumps, hydraulic rams, Archimedes' hydraulic screws, pumps, and water-raising machinery of every description. Class 4. Irrigation plans which are recognised of practical execution and economic utility in Sardinia. The prizes assigned by the Minister of Agriculture are:—For the first-class, one gold medal and the purchase by the said Minister of two apparatus of the system which obtains the first prize, two silver, and two bronze medals. For the second-class, one gold medal, two silver and two bronze medals. For the third class, two gold medals, four silver and four bronze medals. The Minister of Agriculture will purchase, besides, some of the awarded machinery of this class, reserving to himself the selection and disposal of them. For the fourth class, a gold medal, and 500 lire premium.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly Meeting of this Society was held on Wednesday, the 25th July 1883.

W. H. Cogswell, Esq., President, in the Chair.

The proceedings of the last meeting held on the 20th of June were read and confirmed.

The following gentlemen were elected as Ordinary Members:—

G. E. Manisty, Esq., C.S., Magistrate, Cuttack.
Edward Biggs, Esq., Merchant, Calcutta.
Baboo Ishar Prosad Gorga, of Moisadal.
E. W. Reid, Esq., Manager, Latookajan Garden, Assam.
Baboo Sital Chand Nahar, Azimgunge.
Edward J. Lawder, Esq., Private Secretary to the Nawab Vikar-ul-umra, Hyderabad, Deccan.
J. D. Maxwell, Esq., Merchant, Calcutta.
E. A. Samuels, Esq., C. S., Magistrate, Bancoorah.
W. Bleeck, Esq., Imperial German Consul, Calcutta.
R. Deey Spedding, Esq., C. S., Collector, Moradabad, N.-W. P.
The Nawab Vikar-ul-umra, Hyderabad, Deccan.
C. A. Soppit, Esq., Assistant Superintendent of Police, Cachar.
Richard Blechynden, Esq., Junior, Calcutta.

The names of the following gentlemen were submitted as desirous of joining the Society :—

W. Campbell, Esq., Karhurrie Factory, Tirhoot,—proposed by the Deputy Secretary, seconded by Mr. J. E. MacLachlan.

A. M. Bose, Esq., Barrister-at-Law, Calcutta,—proposed by Raja Suttyanundo Ghosal, Bahadoor, V.-P., seconded by Mr. Richard Blechynden, Junior.

J. R. Croft, Esq., Merchant, Calcutta,—proposed by Mr. G. L. Kemp, seconded by Mr. W. Stalkartt.

J. D. Masseyk, Esq., of Jungipore,—proposed by Mr. R. Blechynden, seconded by Mr. G. L. Kemp.

E. A. Dawson, Esq., District Superintendent of Police, Bancoorah,—proposed by Baboo Pertap Narain Singh, seconded by Baboo Joykissen Mookerjee.

Raja Rajcoomar Rai, of Patariaghatta, Calcutta,—proposed by the Deputy Secretary, seconded by Raja Suttyanundo Ghosal, Bahadoor, V.-P.

G. B. Reynolds, Esq., C.E., Assistant Manager, Wurrora State Railway Colliery,—proposed by Col. W. B. Thomson, seconded by Mr. J. E. MacLachlan.

Prince Mirza Mahomed Jahali, Bahadoor,—proposed by Rajah Suttyanundo Ghosal, Bahadoor, V.-P., seconded by Mr. Richard Blechynden, Junior.

Contributions.

A large number of Chrysanthemum and Polianthus roots, and some Begonia cuttings. From Baboo Prosono Coomar Banerjee.

Capsicum seeds from General Dhoje Narsingh Rana Bahadoor, Nepal.

Capsicum seed from Masulipatan,—a quantity from E. H. Boileau, Esq., Forest Department.

The *Indian Forester*, Nos. 6 and 7 of Vol. IX. From the Editor.

Proceedings of the Asiatic Society of Bengal for April 1883.

The *Tropical Agriculturist* for June and July (two copies each). From the Editor.

The Records of the Geological Survey of India, Vol. XVI., Part II., 1883. From Government of India.

Suggestions regarding Forest Administration in the Madras Presidency. From Government of India.

The Adminstration Report on the Jails of Bengal, 1882. From Government of India.

Album Benary No. 7, and a number of large size Floral Pictures. From Ernst Benary Erfurt.

5 lbs. Divi-Divi seeds. From Col. J. Stewart, R.A., Cawnpore.

Communications.—From Major Pitcher, Department of Agriculture, N.-W. Provinces :—"You would greatly oblige me if you could kindly find out through your correspondents in the Mauritius the price of the 'grettouse' and of the 'Casse-tête' implements in use there for cleaning and extracting Aloe fibre. I should like an estimate of the cost of each landed in Calcutta." The Secretary said that Major Pitcher's request had been complied with, but there not been sufficient time to receive a reply. The Casse-tête is the machine alluded to in late proceedings, the use of which appears to require some practice, but one of the garden men is being trained to work it so that it may have a fair trial.

From Messrs. Begg, Dunlop & Co.—Asking for information regarding experiments made with American cotton seed in India. As such a mass of information has been collected by the Society in the last thirty years during which experiments have frequently been made, Messrs. Begg, Dunlop & Co. were referred to the Society's Journals.

Rice-Husker.

Several applications either for drawings or working-models of the Rice-Husker reported on in last proceedings were read ; the Deputy Secretary mentioned that these were being prepared.

Information regarding a machine for *cleaning* and whitening rice has also been received, and will be duly noticed.

Manilla Hemp Extractor.

The following letter received from Mr. Wilkinson, British Consulate, Manilla :—

I have the honour to inform you that I have sent to the Harbour Master at Hongkong, with request to forward to you, a model of a Hemp Extractor as used in these islands. The model is reduced exactly one-half the usual size. The several pieces of wood which compose it are packed up loose, but they can be easily put together by means of the enclosed instructions and diagrams. I have had much difficulty in procuring this model from one of the provinces of this island, hence the delay in sending it to you.

The following is a description of the apparatus in use in the province of Albay, Island of Luzon, for extracting the fibres from the stalks of the wild plantain (Musa textilis) locally known as Abaca, or Manilla hemp :—

Two strong uprights are firmly fixed in the ground and connected by a cross bar, in the centre of which a large broad-bladed knife is fixed edge downwards on a block of wood fastened lengthwise on the bar ; the knife has a strong handle which is connected by a cord to a long bamboo made to act as a spring ; by being tied in the middle and the butt parallel and above the bar, the free end thus forms a supple and powerful spring, and holds the edge of the knife firmly against the block ; below the bar, there is a treadle, attached by a cord to the handle of the knife ; the mode of operation is for the worker to stand opposite the knife, placing either foot on the treadle, which he depresses, thus forcing the knife, handle down and the blade up ; he then places a strip of stalk (called locally *saja*) between the blade and the block, leaving only enough to wrap round a stick, on the near side. He then releases the treadle, and the knife, by the action of the bamboo spring, nips the strip firmly against the block, and on the workmen drawing the the strip through, the pulp is left behind. The apparatus is extremely simple and inexpensive.

Olive in India.

From Messrs. Begg, Dunlop & Co.—"We should feel greatly obliged if you could supply us with some information regarding the cultivation of the olive in India. * * * * It seems strange that the cultivation of the olive which has attained to such importance in the country mentioned should be * * * * * * neglected in India. Any information which you can give we shall be glad to receive, as also particulars as to the best mode of propagation." To which the Secretary replied as follows :—

In reply to yours of the 22nd instant regarding olive culture in India, I append an extract from a report furnished by Dr. Ross in the year 1852, the only experiment to extract oil from the wild olive of which I can find any record. This experiment is alluded to by Dr. Stewart in his *Punjab Plants*, published in 1869, and by Dr. Brandis in his *Forest Flora*, published in 1875, as crucial, and as one that proves that oil cannot be extracted in sufficient quantities to make it remunerative. You will observe in Dr. Ross's report, that the fruit was dried in the sun, and altogether treated in a manner which appears to be quite opposed to the Italian practice, where the fruit is collected into small mounds, and the oil, expressed by their own weight, escapes and runs into a receptacle ; they are then pressed with small mill stones, and the oil obtained by this method too is of good quality. The fruit is then placed in sacks, boiling water poured over them, and again pressed, the produce being inferior in quality ; the oil is then kept in stone jars, and the slimy parts allowed to settle ; these dregs must be removed, or the oil would become rancid.

I will lay your letter before the Council, and will submit a proposal to make a careful trial when the season arrives.

As regards modes of propagation. There are three methods mentioned—cuttings which appear to strike readily, "driving a stout stake cut from a branch" into the ground which throws out roots and grows into a tree, and cutting from a felled tree the wood "between root and trunk" into pieces about the size of a mushroom, taking care that some bark adheres ; which pieces are planted, are fit for transplanting in a year, and for removal to the olive yard in three.

There are a great variety of olives valued each for special qualities. I shall be happy to obtain advice from France as to the species which are most esteemed. I may add that the European olive trees imported into Bengal have not as yet flowered.

Mr. Powell, of the Lahore Agricultural and Horticultural Society, in reply to an enquiry regarding the condition of the imported olive trees tried in Lahore, writes that—"the trees grew well enough in good soil, and even made a show of flowering but no fruit : fruit of the size of a pin's head may form, but they invariably drop off." Mr. Powell adds, he thinks, Chumba and the upper Sutlej Valley suitable places for the introduction of the European variety. "I have at the Agricultural and Horticultural Garden, Lahore, succeeded in raising native olive stocks from seed, and grafting the European olive on them, but though the grafts take perfectly well, none have been down *long* enough to test the probability of fruit."

Indian Wheat, and What its Future may Become.

Towards the autumn of 1882, the Secretary of State for India had instituted a series of experiments, by practical experts, in Indian wheat, thoroughly exhaustive as regards their quantitative and qualitative properties and values, in comparison with those of American and other well known recognized wheats of commerce, and from the analyses of which it is shown that the Indian wheats "afford a larger margin of profit both to the miller and baker than any other." These are such startling facts, they possess so much of interest, not only to members of this Society, but to the public generally, that I feel too great notice and prominence cannot be given to them, so I unhesitatingly give, *in extenso*, the whole of the details of those experiments, the results, and the deductions to be drawn therefrom, as published in the *Economist*, 19th June 1883.

That article was preceded by the publication of a pamphlet here in March last, known by some as the "yellow pamphlet," entitled "Indian Wheat *versus* American Protection ; or, the Influence of English Trade and American protection on the Development of India," so ably dealing with this subject, that the Government of India were furnished with a copy of it, and received a communication thereon from the Bengal Chamber of Commerce.

It shows the position occupied by India as to supplies for Europe, how the trade could be diverted from America to this country, and the advantages to the Indian ryot and to the English manufacturer that would result. There is the following proof of the quality of the wheat raised, proof that it can be raised, and at prices that will place it on fair competitive grounds, and there is ample evidence of the one thing only that is needed to achieve such results ; and that is, cheap communication by the pushing forward of the railways, and the steady growth of their systems.

I understand that the Government of India are using their endeavours to get a reduction of transit rates on all Indian railways, that this is likely to be conceded, and if it is, combined with the active competition for ocean freight, I know of no valid reason why India should not in time supply the whole of what is called the foreign, or imported, wheat into England, which amounts to annually about 56 million cwts., worth 31 millions sterling. Of that quantity about five million cwts., or nearly three millions sterling, went from India.

The question of the probable wheat supply from India is occupying the minds of most thinking men of position and influence in England, and I see no good reasons why it should not go forward, but time will be required to develop it to a much greater extent than known at present ; with this data, however, before Government, and the adoption of the progressive policy so

strongly, yet temperately, earnestly, and ably advocated, the results can be but those of golden harvests for this country.

W. H. COGSWELL.

EXPERIMENTS WITH INDIAN WHEAT.

In October last, Messrs. McDougall Bros., of London, were instructed by the Secretary of State for India to institute a series of experiments with Indian wheat, in order to ascertain how they compared as to yield and quantity of flour with American and other supplies. Conditions under which the experiments were to be conducted are thus set forth by Messrs. McDougall:—

I. That we should take a given quantity of each of these four representative Indian wheats, *viz.*—Indian fine soft white, Indian superior soft red, Indian average hard white, Indian average hard red, and manufacture them into flour by the ordinary process of grinding under millstones. Also that we should take similar quantities of the same wheats, and manufacture them into flour by means of crushing between rollers, according to the system known as the Hungarian or roller system. II. That we should take a given quantity of each flour so produced, and manufacture it into bread. III. That we should note the qualities and other characteristics of the flours produced, also of the offals, *viz.*, middlings pollard, and bran. IV. That we shoud procure the following representative wheats, of fair average quality of the season, as then being sold in Mark-lane market, for the purpose of obtaining results for comparison, deal with them precisely as above indicated, both as regards flour, bread, and offals, *viz.*—English average, American (red winter), American (spring), American average, Californian average, Russian Saxonska, Russian Taganrog, Russian Kubanka, Russian Ghirka, Egyptian Buhi, and Egyptian Saida.

As none of the Kubanka or Ghirka qualities of Russian wheat could be obtained in London, these could not included in the tests. Of each of the other wheats specified, however, 5,000 lbs. were taken as delivered from the ship (weight of sacks or bags not included), and subjected to the treatment specified, the operations being carried out in Messrs. McDougall's own mills and bakeries, under the personal supervision of one of the partners of the firm.

The Evaporation and Loss in Milling.—The percentages under this heading, it will be noticed, vary considerably, from No. 11, Russian Saxonska, stones, 0·7; rollors, 0·2; to No. 13, Egyptian Buhi, stones, 5·5; rollers, 5·4. These variations must not be attributed chiefly to the differences in qualities of the wheats, as they arise mainly from the waste and loss that is inseparable from working small quantities on a practical scale; about ten quarters of each wheat were operated upon in these experimental workings, whereas in ordinary milling a "grist" will run from one thousand to several thousand quarters. This will be readily understood, when it is borne in mind that, after the working of each separate wheat by either process, the stones or rollers, hoppers, elevators, dressing silks, &c., have to be swept out, and it is impossible to avoid some waste from this cause. In milling operations it is found there is a larger loss, &c., "unaccounted for," on inferior wheats than upon good wheats, but it does not exceed a total of 1 to 2 per cent. For practical purposes, the items, evaporation and loss, should be taken as obtained by competent millers, namely, four stones, 1 to 2 per cent; from rollers, 1 to 3 per cent, according to the qualities of wheats.

Water used in Bread-making.—The differences in the quantities of water required by each of the flours from Indian wheats per 280 lbs. flour in making them into bread (ranging from 140·6 lbs. to 141·0 lbs. water) is partly accounted for, by the fact of somewhat similar variations in the water absorbed in rendering the wheats mellow for milling.

Weight per Bushel of Wheats.—These experimental workings have brought to light a fact well worth noting, *viz.*, that the rule so generally held amongst wheat sellers and buyers, and thought to be without an exception, that the greater the weight of a bushel of wheat so much higher must it rank as a flour-yielder, and consequently in value, must now be regarded as true only within a strict limit. A high standard of weight for any given cubical measurement is, no doubt, a good criterion as to dryness of condition and soundness of the grain, for any dampness in grain causes it to weigh *lighter* per bushel or quarter of measurement instead of heavier (a fact which will surprise the uninitiated). But experienced parties will study with interest three columns in the synopsis of the wheats, showing "weight of 100 separate grains" of each wheat, "weight per bushel," and "yield of flour." Taking equal weights of the four Indian wheats, it will be found that No. 3, weighing 60 lbs. per bushel, yielded more flour than No. 1, weighing 64 lbs.; also, that No. 4, weighing 60 lbs. per bushel, yielded more flour than No. 2, weighing 62½ lbs. The reason of this is evident. The four wheats were equally and perfectly dry, and probably would have weighed the same per bushel had the size and shape of the grains of each wheat been the same, but they differ widely in this respect, Nos. 1 and 2 being medium or small, and Nos. 3 and 4 long and arched. Hence the latter will not fill into a measure as closely as the former, leaving larger spaces unoccupied, and causing any given measure to weigh less in consequence. The old rule holds good for wheats, the grains of which in size and shape are similar, but it will only mislead if applied to Indian wheats like Nos. 3 and 4. It was, doubtless, adopted at a period when it was the custom for all wheats to be sold by measure, and for sales by measure it is still a correct guide, but as sales are now made by weight rather than by measure, the rule can only safely be applied within the limits indicated.

The Offals.—This is a subject of minor importance as compared with the yields and qualities of flour and bread, and it is only needful to state that, of the offals included in these returns, the middlings from both systems of milling were worked down to the quality known on the Mark Lane market as "coarse mids, fair average," the bran to "bran from stones," and "bran from rollers," and the pollard to "pollard, fair average."

Gluten in Bread.—From an economical standpoint, it may be said the nutrition of bread mainly depends upon the gluten, or, in other words, the nitrogenous or albuminous compounds or flesh formers, contained in the flour from which it is produced. The starch would be equally important if it could not be obtained from other sources in as suitable a form at a much cheaper rate—as in rice, Indian corn, and potatoes. But the gluten is not obtainable from other sources, of equal quality and flavour. Hence its special value as a constituent of wheat. Further, upon the gluten in flour depends the elasticity of the texture of the bread, and consequent freedom from density or heaviness. It is generally believed that upon the percentage of gluten in flour depends the *yield* of bread that may be obtained from it, as illustrated by the Hungarian flours, which are almost unequalled for yield of bread, and rank high in gluten; but this is erroneous, as proved by the experimental workings now under review. It would be found that the flours high in gluten do not produce the most bread, unless, at the same time, they possess a high degree of *dryness*, for it is upon the dryness of the flour that the yield of bread mainly depends, and not upon the gluten. The two lots of flour from Russian wheats (Nos. 11 and 12) are those which are highest in gluten, yet they do not yield as much bread as any of the four Indian wheats (Nos. 1 to 4), and the difference in yield from the latter would have been still further increased had they not been previously mellowed with water, as noted, before milling; confirming that it is the dryness of a flour that determines the yield of bread.

Another erroneous idea is, that upon the quantity of gluten present depends the height or loftiness of the bread. This would be correct, provided the fermentation of the dough were in all cases carried to a precise degree; but it varies widely, and it will be found the loftiness or height of the bread depends chiefly upon a high degree of fermentation, provided it be not carried to great excess, rather than upon the gluten. This is illustrated by the bread consumed in the London district, which is made from flours rich in gluten, yet is not so high or lofty as the bread consumed in some other districts, which is produced from flours containing much less gluten, the popular taste in London demanding strength, nutrition, and then fair colour, whereas, in the districts referred to, a high degree of whiteness is demanded before nutrition.

THE FOUR INDIAN WHEATS.

In addition to the particulars contained in the foregoing returns, we have to report that to any one experienced in the requirements of the wheat and flour markets of the United Kingdom, and, indeed, of most other countries, it will be evident there is no probability of these Indian wheats coming into demand for manufacture into flour *without a liberal admixture* of other wheats. They all possess in a marked degree the same characteristics of great dryness, and a distinct beany and almost aromatic flavour, inseparable from wheats grown in the climates and soils of the tropics. Also the flours are ricey, the texture of the bread is too close, and the crust is hard and brittle. But these characteristics do not detract from their usefulness in any important degree. As is well known, a miller cannot show skill in his craft to greater advantage or profit than that with which he selects his wheats, and mixes his grists, so as to produce to best advantage a flour from which bread can be made of the colour, bloom, strength, and flavour desired, and withal a good yield.

We pronounce them to be exceedingly useful wheats, in fact, hardly equalled for what is deficient and wanting in the English markets by any other wheats. Their chief characteristics are just those in which the wheats grown in our variable climate are most deficient. Their great dryness and soundness render them invaluable for admixture with English wheats that are in any degree out of condition through moisture, and the great proportions of the wheats harvested here have been in that condition for some years past, a condition that must prevail in all other than that of wheats harvested and stored during fine and favourable weather; and this the English farmer knows, greatly to his cost, is a state of climate that is by a long way the exception rather than the rule. Added to their dryness, the thinness of the skins of these wheats, and consequent greatness of the yield of flour, must always place them in the front rank as a "miller's" wheat, whenever they are handled with reasonable intelligence and skill.

Such unprecedented yields of flour, as shown by these wheats, ranging (by ordinary grinding) from 77·46 to 80·52 per cent against English 65·2 and American spring 72·2, speaks volumes in their favour, and their value is still further increased by another point of merit of almost equal importance, *viz.*, a larger percentage of bread may be obtained than from any other of the flours included in this review.

That, for the best of these Indian wheats (the fine soft white), on the day they were valued in Mark-lane market, a price was offered as high as that for American winters. New Zealand or English (see list of values in synopsis) proves that the great value of the Indian wheats is becoming recognised here, a knowledge that will ere long extend to all our markets. The other lots of Indian (Nos. 2, 3, and 4) were lower in value to the extent of 4*s.* to 5*s.* per quarter, as might almost have been expected from the difference in colour and other characteristics; still, as these latter wheats become better known here, this difference in price will be somewhat lessened. Their beany flavour is not a serious obstacle, as fair average deliveries, when well cleaned and properly dealt with, can be employed in the proportion of 25 per cent to 50 per cent along with home-grown or other wheats, such as Americans, possessing a fine sweet, milky, or nutty flavour.

Glancing at all the facts here elaborated, it is evident that these wheats afford a larger margin of profit both to the miller and baker than to any other.

We venture to record a conviction we have long held, strongly emphasised by the results of these experimental workings, of the measureless importance of the great resources of the Indian empire being developed to the utmost in producing wheat for this country. Farmers here are finding that to live they must produce beef and mutton rather than grain, hence the greater need of resources of supply under our own control.

It is evident such a conviction is common to the members of your Honourable Council, as testified by their unceasing efforts in this direction. And we desire heartily to congratulate them upon the important fruits arising from their labours. The character and general excellence of the Indian wheats are improving with the deliveries of each successive season. The Indian wheats now specially under review were delivered to us in excellent condition (see details) with freedom from dirt (except lot No. 3), barley, gram, and other impurities, also with a freedom from weevil, rarely equalled by Indian wheats, except the prime parcels of the past season, and there is no doubt an outlet in this country and the European continent for unlimited quantities, at prices that shall prove remunerative to all parties concerned, either in their growth, transportation, or conversion into flour and bread.

GARDEN.

The Garden Committee's report was read ; they intimate that a new catalogue of plants is in course of preparation, which will be ready at an early date, when a copy will be sent to each member.

The usual Monthly Garden Report was then read.

Since the last meeting good progress has been made in garden work.

A great deal of labour has been taken up in the levelling of the large lawn; however, advance has been made, and the work, when completed, will be a permanent improvement, and will add greatly to the general appearance of the garden, and render it more attractive to visitors.

Hoeing and breaking up the ground throughout the orchard has been commenced, a very necessary though troublesome piece of work, which it will take some time to do thoroughly, as it covers a considerable piece of land.

In the last garden report it was mentioned that a potting-shed was under construction for work during the rains ; this has been completed and has been of great use during the heavy rains we have been experiencing in the month under review.

A bamboo fence, some seven foot high, to enclose 150' × 75', including the propagating-shed, is being made, and will be finished in the course of the month ; when the fence is covered with creepers and closed with a door, there will be a good and secure place in which to keep the more valuable plants ; the want of which is now greatly felt. The material for this useful work is supplied entirely from the garden.

The few Amber cane which germinated, are now in flower, they were sown on the 29th of May, and have thus taken only about sixty days to mature, so this variety of Sorghum is well named the Early Amber. It is proposed to try another crop of cane in the same land, a report of which will be duly given.

The instructions given by the Garden Committee in reference to collecting plants, near and around the plant house, are being carried out, and a road has been commenced which they pointed out as desirable.

A portion of the lane leading into the garden on the eastern side has been widened and the clearances made round the house formerly allotted to the Gardener, now occupied by the Deputy Secretary, give that side of the garden a more pleasing and ornamental appearance.

Propagation is being carried on vigorously, and the stock of plants has thus been largely increased. The following are still available :—

Mahogany, Coffee, Teak, Ceara Rubber, Paper Mulberry, Sago Palms, Poinciana Regias, Sissu, Sivistonia humilis, and other Palms.

Flowers have on several occasions been supplied free of charge to many charitable institutions on application.

RICHARD BLECHYNDEN, Junior,
Deputy Secretary.

OFFICIAL PAPER.

PRICKLY-PEAR AS A SHELTER FOR TREE-SEEDS.

IN accordance with the official memorandum of Government, Collectors were called upon to report the result of any experiments, made by them in the direction, suggested by Mr. H. S. Thomas, of using prickly-pear as a shelter for tree-seeds when sown broadcast amongst masses of it.

The Collectors' replies are now submitted to Government with the following remarks :—

In Anantapore, South Canara, Ganjam, Kurnool, Malabar, Nilgiris, Tinnevelly, and Vizagapatam, there is happily no scope for the experiment, as the cactus is either scarce or altogether unknown.

In several districts where tree-seeds have been sown broadcast, sufficient time has not elapsed to allow any seedlings, which may have sprung up, to show themselves above the prickly-pear. This applies specially to Nellore, Coimbatore, Trichinopoly and Salem ; and probably to North Arcot, Kristna and Chingleput, where experiments on a limited scale are reported to have failed. It is to be regretted that (except in the case of Nellore) the Collectors have not furnished definite information as to the areas dealt with, or as to the kind, quantity, and cost of the seed sown, and of the labour employed, as to gauge the results by outlay.

In Bellary and Tanjore, no experiments had been made when the reports from these districts were submitted, but the Collectors promise that experiments shall be instituted at an early date.

In Cuddapah, over 1,300 plants are said to have risen from some tamarind, margosa and jambu (*Eugenia jambolana*) seed sown by the General Deputy Collector in six villages. Information is wanting as to the quantity and cost of the seed used, and as to the approximate area over which it was scattered, and the cost of scattering.

In Madura, it is said that there are no dense clumbs of prickly-pear, except in the Melur Taluk. Some margosa seed was sown amongst it in this taluk without result. Particulars as to quantity and area are wanting.

The Collector of Godavari reports that in that district, prickly-pear is chiefly found in and near village-sites, " where its presence is a nuisance which ought to be got rid of." But as it is not got rid of, it should be utilized till it is. It is believed that, apart from the trouble attending its removal, the villagers in some places are very loth to see it destroyed attributing the saving of their lives to it in no small measure in famine, as the cactus bears edible pears in the severest drought. This was notably the case in Coimbatore. The consumption of the fruit by human beings accounts for its propagation chiefly in and around village-sites. While, therefore, this experiment need not interfere with the removal of cactus when it is desired to remove it for cultivation, or because of the harbour which it possibly gives to snakes in villages, so long as it is left standing, it should be utilized as a conservator of trees. In twelve villages some casuarina, tamarind, mango, margosa, palmyra, and date seeds were sown. The casuarina seed did not germinate, possibly from having been carried off by ants, as has been found the case elsewhere. Why the palmyra and date should have failed, is not mentioned ; possibly they have not yet had time to germinate, as these seeds seldom show above ground for about a year, and sometimes lie inert but alive in the ground for two or three years till there is a good rainfall. A few tamarind, mango, and margosa seed germinated, but on the whole the result of the experiment does not seem to have been thought encouraging. The Board believe the chief thing wanting is time. They notice, however, that " twenty mango and twenty tamarind trees " are spoken of as " planted " in one place. The *planting* of grown trees is no part of the experiment, and similar misunderstandings in other places may perhaps account for the want of a greater proportion of success.

In Nellore, the experiment has seemingly been very thoroughly tried and certainly on a large scale. In the Gudur Taluk, 1,183 measures of tree-seed and 1,650 palmyra kernels were sown over 527 acres of prickly pear. Sufficient time had not elapsed to judge properly of results, but none of the seed had germinated at the time of the Collector's report. In the Atmakur Taluk, 1,810 measures of seeds were sown over 112 acres. A few saplings are reported to have been seen amongst the cactus; but as more than two years h d elapsed since the sowing, the Collector believes that the bulk of the seed did not germinate. In the Kandukur Taluk, 27 acres were sown in 1880 with a " very large " quantity of seed, and after two years, eighty saplings was the apparent result. In the Kanigiri Taluk, 1,080 measures of seed and 1,000 palmyra kernels were sown over 120 acres in twenty villages. From this seed, 890 seedlings of sorts and 341 palmyras have germinated. This is the greatest success that the Collector can chronicle, and he considers that " as a practical measure to be taken into consideration in the operations of the Jungle Conservancy Department, the experiment stands condemned."

In Trichinopoly, some margosa and tamarind seed was sown broadcast in more than seventy villages, and as the result of this sowing, 364 tamarind and 1,886 margosa seedlings are said to have already sprung up. The Collector thinks the experiment a success ; but it would have been more satisfactory if the value of the seed and labor expended had been stated, so that returns might be compared with the cost.

In South Arcot, the plan advocated by Mr. Thomas is stated to have been practised ever since 1874 by the Deputy Conservator, Mr. Wooldridge, who, while adding certain interesting differences of opinion founded on experience and printed in G.O., 14th August 1879, No. 1702, and Board's Proceedings, dated 20th April 1882, No. 1135, says " there can be no doubt of the results of the system," and gives as results 6,257 seedlings above one foot in girth and 31,422 less than one foot in girth, remarking in one place, " self-grown now like a tope." He also utilizes dense beds of dwarf wild date in the same way. Mr. Wooldridge adds that in his experience the increased shade and moisture from the growing trees has been found to destroy the cactus in time—a view held also by Mr. Steavenson ; and as it is ordinarily found that in thickly-grown wood, grass is exterminated, it may well be that in course of time, the same result will follow in cactus. That the cactus does not suffer under single trees under which it still gets all but the midday sun, is no evidence that a plant which lives so much on sun and air will not die out when thoroughly shut in by a thick tope, such as Mr. Woodridge has raised in it. It will probably then be found to live only as a fringe.

The Collectors (Vizagapatam excepted) have not dwelt on the question of employing prickly-pear to protect avenue seedlings. In Vizagapatam, the Local Fund Board declined to sanction the experiment on any of their roads, on the ground that it would spread the growth of a pernicious pest. Probably this would be the view generally taken, and it may be remarked that, while the idea finds place among the papers circulated, it was neither Mr. Thomas's proposal nor the Board's recommendation that the cactus should anywhere be propapated for the protection of avenue or other trees, but merely that, where it was found to be in existence,

it should be utilized in place of being looked on as an unmitigated evil.

Some reports are meagre, and Mr. Macleane's particularly so. He will now report what measures he has taken for broadcast sowing seed in cactus, and the time of sowing.

Looking to the markedly successful results obtained by the Deputy Conservator, Mr. Wooldridge, whose reports are worthy of perusal, the Board are disposed to think that the want of success in other parts may be attributable in very great measure to want of time for the appearance of the saplings above the cactus where it is 5 or 6 feet high, and perhaps also in a less degree to ill-selection of the time for sowing, so that the seedlings did not get the whole rainfall, or to season, and in some places, seemingly, to misunderstanding. Considering that the experiment is not expensive, the Board would wish to see it renewed.

SELECTIONS.

THE POONA RAYAT'S BANK.

PAPER BY SIR WILLIAM WEDDERBURN, BART.

I PROPOSE to-day to lay before you a statement of what has been done up to date towards establishing Agricultural Banks in India; and my object in doing so is to ask for your help in obtaining for the undertaking the support of the English public. We may safely assume that all who come to a meeting of this Association are well-wishers of India. And on the present occasion I am the more encouraged to count upon your active sympathy, because of my past experience when discussing this question of Agricultural Banks. As regards no other proposal have I found so general an unanimity among people of various shades of opinion. All agree that the financial position of the Indian rayat is not what it ought to be, and might be; and all agree that arrangements are urgently required for supplying him, on reasonable terms, with the capital without which cultivation cannot be carried on. I shall therefore, without further preface, proceed to consider the question in its business aspects, setting forth the facts of the case and the considerations which will, I think, satisfy the investing public that the undertaking rests upon a good commercial basis. Though land banks have prospered in other countries they are new to India. We have therefore felt, in approaching the present undertaking, that the first thing to be done is to acquire a certain amount of local and special experience by observing the actual working of such an institution in India. And this it is proposed to do by starting an experimental bank, under good local management, upon a limited scale and within a limited area. For various reasons the Poona District has been selected for the experiment; and the system followed will be that which has been found most successful in practice elsewhere, modifications being gradually introduced as experience may suggest. When trustworthy facts and figures have thus been collected, we shall know what rocks and shoals are most to be avoided, and we shall be in a position to decide in what direction, if any, a business of this kind can be safely and profitably extended.

In order to make the situation clear I will deal with the subject in the following order:—(1) I will give a brief sketch of the Dekkhan rayat's position, with special reference to his dependence on the moneylender, and his financial difficulties in consequence of the exorbitant rate of interest he now pays. Next (2) we may notice what has been done in other countries, Germany, Italy, Australia, Egypt, in the matter of Agricultural Banks. I will then (3) show how it is proposed to apply a similar system in the case of the Poona experiment. And in conclusion a few observations may be added as to the advantages and disadvantages of India as a field for enterprise of the present kind. In dealing with these several topics I will be as brief as possible, being anxious to leave ample time for discussion, and for the criticisms and suggestions with which I trust we may be favoured.

(1) *The rayat's dependence on the money-lender.*—In order properly to realize the important functions which capital has to perform in the rural economy of India, it is necessary to have a clear view of the peculiar position of the cultivator. In the Dekkhan the arrangement is a sort of partnership between the rayat, who is a peasant proprietor, on the one part; and the village saukar, who is the local capitalist, on the other. The rayat owns the land and the cattle, and supplies the labour by himself and his family. On the other hand the saukar maintains the whole party until the harvest becomes available, and provides cash to pay the Government assessment and for incidental expenses, as when a bullock dies or when a marriage has to be celebrated. He also generally supplies the seed corn. The crop thus obtained is shared between them; and this arrangement is a fair one, seeing that any profit that may accrue is the result of the rayat's labour and the saukar's capital. To use the words of Lord Cranbrook, the existence of the money-lender in the village polity is as essential as that of the ploughman. Now this customary dependence of the rayat upon the village saukar must be constantly borne in mind when dealing with any question of the present kind. For the connection is not a temporary or exceptional one produced by accidental causes, but is permanent and necessary, the co-operation of the money lender being to the rayat one of the conditions of his existence. And this fact was strongly insisted on by the speakers in the great debate at Simla in 1879, on the Dekkhan Agriculturists' Relief Act; Sir John Strachey pointing out that "money-lenders are obviously as necessary to the Indian agriculturist as the seed which he sows, or as the rain which falls from heaven to water his fields." There is, in fact, no doubt that the rayat needs the saukar's help. But it is always possible that this help may be purchased too dear; that in the division of the partnership profits, capital may get too much and labour nothing at all. And this will be the case if the rayat pays a higher rate of interest than the profits of cultivation warrant. Now in the Dekkhan the ordinary monthly rates of interest are 1, 2, and 3 per cent, according to the credit of the borrower; that is, the rayat with good credit can get money at 12 per cent. per annum; the man of middling condition pays 24 per cent; while 36 per cent, and even more, is demanded from the man who needs money badly. For the average borrower we may take 24 per cent as the rate. And it is quite evident that no system of agriculture can pay if burdened with such a charge upon the capital employed. What would an English farmer say to such a drain upon his resources? In order to meet punctually a charge of 24 per cent, the profits of a business must be not only abundant but also regular. And the profits of cultivation cannot be regular when they depend upon the Dekkhan rainfall, which is proverbially uncertain. As yet irrigation has been but little extended; and as regards unirrigated land we are told on authority that the cultivator "hardly gets a full crop once in three years." The return cannot therefore be regular. Again, compound interest mounts up if, owing to bad seasons, payments fall into arrears. And finally, when the debtor gets into serious difficulty he is sued in the civil court which, as we all know, is an expensive process. For a claim of Rs. 100 court fees of sorts amount to about Rs. 25, and there are besides heavy incidental costs, all of which ultimately fall upon the debtor. Under these circumstances we cannot wonder that one peasant after another becomes embarrassed, and that having once stumbled he finds it hard to get upon his feet again. Indeed the wonder is how the rayat can maintain himself at all. And that he does so shows how bravely he carries on the struggle, and how deeply he is rooted in the soil. May we not hope great things from him if he were less heavily weighted, if, for example, he could get his capital at 9 per cent, instead of at 24 per cent, with costs and compound interest in addition? And indeed when we come to ask the question, Why should the Indian peasant be thus left unaided to carry on so heart-breaking a struggle, there is no good answer to be given. In former times when each Indian village was an isolated community, when all the villagers had to draw their loans from the slender store of one local lender, it might be reasonable that they should pay 24 per cent. But it is no longer reasonable now, when communications have been opened up, and when the Indian landholder can have access to the accumulated capital which in Europe is anxiously seeking channels for safe and profitable investment. It is as though on the one hand we had a rich but thirsty soil: on the other hand vast stores of fertilizing water. What we need is a channel of communication in order to benefit all parties. The problem is a simple one. All that is wanted is a little enterprise and a little organization.

(2) *Agricultural Banks in other countries.*—Now, when we propose to establish an organization we naturally look to see what has been done elsewhere under similar circumstances. And fortunately we have examples before us in Europe of popular land banks which have been in operation for many years, and are still spreading with the greatest benefit to all concerned. Land banks, under the name of mortgage debenture associations, were first founded in Prussia by Frederic the Great, and they have attained special development among the peasant proprietors in the Rhine provinces and in Italy. The details of the system and an account of the land credit institutions throughout the continent will be found in a valuable blue book published in 1870, and entitled "Reports from her Majesty's Representatives respecting the tenure of land in the several countries of Europe." Success appears to have invariably attended these financial undertakings. Even in Turkey the system seems to have worked well in spite of the ruined condition of the peasantry. Mr. Consul Blunt, speaking of a land bank in the vilaet of Adrianople, reports that the agricultural interests of the country derive great advantages from this institution: the custom, so prevalent among the small farmers, of borrowing money at exorbitant rates of interest in anticipation of their crops which ultimately placed them at the mercy of a host of relentless usurers, is fast giving way before the facilities offered by this institution, which enables the peasant proprietor to borrow advances at 12 per cent per annum on very moderate security. The Trustees of these 'National Borrowing Funds' propose lowering the rate of interest to 8 per cent next year. It is an undisputed fact that these funds have very much contributed to place the peasant farmers in some districts on a solvent footing; many of them have not only paid off their old debts, but have also improved their properties." These are the results we should gladly see produced in India by a similar system; and, as a nation, we are surely in honour bound not to be behind the Turk in a matter of this kind. I now hold in my hand copy of a paper, "De l'organization du crédit agricole," recently read by the eminent economist, M. de Laveleye, before the Belgian Agricultural Congress. In this paper he brings up to date the facts and figures relating to land banks, and specially commends the "Raiffeisen Agricultural Loan Unions" of Germany, co-operative associations of peasant proprietors which sometimes comprise whole villages and districts. Next to Germany comes Italy in the development of these popular land banks. In 1880 they were 133 in number, the subscribed capital being about 42½ millions of francs. Their loans had then reached 122 millions, and they had 100 millions of deposits. In the Australian Colonies the system of mortgage banks seems to have specially prospered, yielding dividends of from 15 to 25 per cent to the shareholders. The experience in Egypt is also encouraging, especially as regards India. For there two companies, one English and one French, have been working with considerable success; and the position of the Egyptian cultivator bears a close analogy to that of the Indian rayat. As

regards the method of doing business, it will of course be understood that all these institutions carry on their loan operations with borrowed money. The secret indeed of their financial success depends upon keeping down the amount of their own paid-up capital upon which a dividend has to be earned, while making their loans to landholders out of capital borrowed from the general public at low rates of interest. In this way a small margin of profit on each transaction will, upon a large business, yield a handsome dividend to the shareholders. The methods by which the required capital is obtained by banks and credit companies are various. A large amount is obtained in the form of deposits, either at call or for fixed periods. But a still more convenient mode of raising capital is by the issue of mortgage debentures, a system originally borrowed from the Prussian institutions already referred to and in England regulated by the Mortgage Debenture Acts of 1865 and 1870. As some present may be not familiar with the process, I will briefly explain how the system is worked. Let us suppose that A, a landholder, wishes to borrow £1,000. He goes to the Credit Company and executes a mortgage on his estate, and the company advances him the £1,000 on being satisfied that his title is good, and that the value of the land exceeds at least by one-third the amount advanced. Similarly, B and C execute mortgages for the sums they require, say £2,000 each. The law now allows the company to deposit these mortgages with the Registrar of the Government Offices of Land Registry, and to issue mortgage debentures, say 100 of £50 each, to an amount not exceeding the sum total, in this case £5,000, of the mortgages of A, B, and C; each of these £50 debentures being charged not only on the aggregate estates of A, B, and C, but also upon the whole property of the company, including the reserve fund and unpaid subscribed capital. The debentures are issued for fixed periods, and are transferable by endorsement; they carry interest, payable half-yearly, by coupons, and summary powers are secured to the holder for the immediate recovery of all arrears of principal or interest. Such mortgage debentures, being a very convenient form of investment, are readily taken up by insurance companies, by trustees, and by private investors; and, being secured upon the whole property of the company, they are placed on the market at a rate of interest below that which is demanded from the private borrower. The company thus occupies the position of a credit institution between the landholder, who wishes to improve his estate, and the general public who wish a safe investment without the trouble of inquiring into titles. And the profit for these good officers consists of the difference in the rates of interest; A, B, and C borrowing, say, at 5 per cent, while M and N, the investors, are willing to lend to the company, say, at 4 per cent. To illustrate the process still further we may take the figures of an institution of this class, the Land Securities' Company (Limited), incorporated in London eighteen or twenty years ago. The subscribed capital is £1,000,000, of which only £100,000 are paid up. From the returns made in conformity with the Act, it appears that up to March 1881, the amount advanced was about two and half millions sterling. The whole of this sum, except about £10,000, had been borrowed by the company on mortgage debentures. If therefore we suppose that the company took a profit of 1 per cent on these transactions, borrowing, for example, at 4 and lending at 5 per cent, these figures would represent a gross profit for the shareholders of £25,000 per annum, equal to 25 per cent upon the paid-up capital of £100,000.

(3) *The history of the Poona experiment.*—For nearly half-a-century the relations of the rayat to the saukar have exercised the mind of the Bombay Government. It was seen on the one hand that the rayat could not exist without the money-lender, and on the other hand, that by constant borrowing he was falling into hopeless debt. The problem was how to supply him with capital without the loan becoming the cause of his ruin. As long as the private lender is left uncontrolled, he evidently goes on lending as long as it is profitable to himself, regardless of the consequences to his debtor. It became therefore the idea of the rayat's friends to organize a financial institution which should deal on some recognized principles compatible with the rayat's well-being, instead of leaving him to the tender mercies of hungry and competing creditors. The rayat is in India the goose which lays the golden eggs: a good and patient bird which will lay enough for all if properly cared for. The object is not to let him be torn to pieces in a struggle for his flesh and his feathers. In 1860 a proposal was brought forward by Mr. Jacomb, of the Bombay Civil Service, to establish agricultural banks in the Dekkhan, and upon the correspondence the following resolution was recorded in its favour by the Government of Lord Elphinstone:—"In all countries where landed property is much sub-divided, the majority of the peasant proprietors are overwhelmed with debt, and it is notorious that in India the ryots are cheated and oppressed by the money-lenders. His Lordship in Council therefore cannot but think that any loan bank which advances money to the ryots upon fair principles and at a reasonable rate of interest should be encouraged, as tending to keep down undue exactions, and as furnishing an industrious ryot with means to dig a well, or otherwise improve his land." Nothing practical however was then done. And the silent struggle between the rayat and the saukar did not receive special notice until the subject was forced upon the public attention by the serious agrarian disturbances of 1875, when the chronic antagonism of the classes broke into open hostility. The Dekkhan Riots' Commission was then appointed. And in 1879 their report resulted in the legislation known as Mr. Hope's Act; the chief feature of which was to "disarm" the creditor, by taking from him the power of recovering debt by imprisoning his debtor and selling his land in execution. Now, though these provisions at once put a stop to the severities of creditors, it cannot be said that they do anything directly towards supplying cheap capital to the rayat. On the contrary, by damaging his credit with the capitalist, they tend directly to increase the difficulty of getting loans on favourable terms. Indirectly, however, the Act has no doubt done something towards a solution of the problem, by driving the native capitalists to devise some means by which their business may be carried on under the altered conditions: by inducing them to join the movement for the establishment of a central institution to be carried on upon sound principles and under first-class management. In this idea they were encouraged by those who took an interest in the scheme on public grounds. And accordingly in March, 1881, a rough project for an agricultural bank was drawn up under the auspices of some leading capitalists in Bombay; and the Hon. Mr. Mandlik undertook to introduce in the Local Council a Bill for its due incorporation, supposing that Government agreed to the concessions which were considered necessary for the success of the scheme. Among the concessions asked for, two of the most important relate to the settlement of the rayat's old debts, and to the method by which the advances of the bank are to be recovered. It is evident that the bank cannot safely deal with a man oppressed by an incubus of paper debt, even the amount of which is not known, and against whom creditors hold bonds and unexecuted decrees. To make fresh advances under such circumstances would be to put materials into a quicksand. And a settlement of the old debts is absolutely necessary before we can have a firm foundation upon which a solid business can be built up. Such a settlement might perhaps be effected privately by gradually buying up the debts, but this would be a difficult and tedious matter, and besides claims might be held back. Accordingly it was represented to Government that this settlement would best be effected by means of a commission acting under legislative authority. And it was also pointed out that such a liquidation formed part of the original scheme of the Hon. Mr. Hope for the relief of the distressed districts. I am glad to say that the Government of India have responded in the most liberal spirit to these representations; agreeing to carry out a voluntary liquidation by way of experiment in one division of a Dekkhan district in the way proposed. They have also agreed to advance the cash necessary to compromise the claims, the amount to be collected from the rayats in moderate instalments over a term of years. A similar liberal spirit has been shown as regards the collection of the bank's future advances. It is in the interest of all parties, the rayat, the bank, and the Government, that the process of recovering agricultural advances should be effective, cheap, and expeditious. Hitherto in case of default they have been collected through the Civil Courts. But experience shows that this method involves the maximum of friction with the minimum of result. Government have therefore agreed that the bank's advances should be treated as advances made under the Land Improvements Act, and recovered when necessary through the revenue officers of the district and village, instead of by the machinery of the courts and bailiffs. This is the system followed in Germany where the bank's advances are recovered with the land tax. And it seems a reasonable one, as the bank will in fact be carrying out, through private enterprise, a duty which those Acts seek to perform by departmental agency at the expense of the State. The policy of Government on these important questions was announced in November last by the Hon. Major Baring in his speech on the Bill to amend the Land Improvements Act. He on that occasion explained that Government wished as far as possible to improve the system under which agricultural advances from the Treasury were made and recovered under the Act, but that they hoped much more from the encouragement of private enterprise. He then specially referred to Agricultural Banks, and stated the concessions above set forth. This very encouraging announcement naturally gave great heart to those interested in the scheme. Meetings were held at Poona, and a committee formed; and on the 23rd of November last an influential deputation of leading capitalists waited on H. E. Sir James Fergusson at Government House, and set forth in some detail the arrangements which according to their experience would be the best in order to establish an experimental bank in the Poona District. They proposed that the experiment should be tried in the Purandar Taluka or sub-division, and that the capital of the company should be Rs. 10,00,000 in shares of Rs. 500 each. In reply to this address, H. E. expressed his sympathy with the movement, and mentioned that he had personal experience of similar institutions in the Australian Colonies, which had been very successful. He referred specially to one in New Zealand whose working capital was three millions sterling, which had paid a dividend of 15 per cent for many years, and had accumulated a reserve fund of £300,000. Subsequently to this interview, a formal despatch, dated December last, was received by the Bombay Government from the Government of India, and in this are set forth in full the views indicated in the speech of the Hon. Major Baring. A copy of this despatch was supplied to the Poona Committee, and upon this they have given a further detailed statement. These important documents are too lengthy for me to attempt to summarize them within the limits of the present paper. But I have had them printed in a convenient form, and shall be happy to supply copies to those interested in the undertaking.

We have now dealt with the three points indicated at the commencement of this paper—(1) the rayat's dependence on the moneylender; (2) Agricultural Banks in Europe and elsewhere; (3) the history of the Poona experiment. And there only remains to make a few remarks as to the general prospects of the scheme. I will therefore conclude by noting what appear to be the special advantages of India as a field for such an enterprise. I will also candidly admit the special difficulties; pointing out how it is proposed that these should be met. Among the leading advantages in India I would mention (*a*) the large margin of profit from cultivation

when capital provides irrigation and manure; (b) the merits of the rayat as an honest debtor; (c) the existence of a skilled agency for money-lending: and (d) the favourable attitude of Government. (a) As regards the possible profits of Indian agriculture under favourable circumstances, I only wish all present could witness the almost magical transformation effected round the city of Poona by means of water and manure. Ten years ago this land produced only a ragged crop of millet, worth perhaps Rs. 5 or 10 an acre, and dependent for its existence on the periodical rains. Now the same land is covered with a magnificent crop of sugar-cane, and when I left Poona the other day it was being sold as it stood on the ground for about Rs. 500 an acre. This is simply the result of capital, the landowners in the immediate vicinity of Poona being men of some means who could afford to take water from Fife Tank and "poudrette" from the Municipality. No doubt the price I have mentioned was exceptionally high, the cane being retailed in the city by way of a sweetmeat. Such a price could not of course be maintained if sugar cultivation was largely extended in the locality. But I mention the example as coming under my personal observation. Also under ordinary circumstances the net profits of sugar-cane are estimated at from £10 to £20 an acre, the cost of cultivation being about Rs. 100 per acre, while the crop does not sell for less than Rs. 200 or 300. Nor is sugar-cane the only profitable garden produce. In the neighborhood of Poona we find extensive spice plantations and vineyards with orchards of mangoes, plantains, and oranges. The rayat is also becoming a considerable grower of potatoes, carrots, and so forth. Indeed, throughout India we find that with capital at his back the rayat can produce any crop for which there is a foreign demand—cotton, wheat, spices, tobacco, jute, oilseeds. For it is the characteristic of India, with her rich soil, varied climate, and skilful "petite culture," that she can produce of the best quality whatever is demanded by foreign trade. Whether it be opium or indigo; rice or tea; coffee, cotton, or tobacco; if she has only time India will always place her products in the first rank among the markets of the world. My proposition therefore is, that in no other country does capital employed upon land give so rich and so certain a return; and that the difference in value between "dry-crop" and "garden," between a precarious crop of millet and an assured crop of sugar-cane, provides an ample margin upon which the capitalist can rely for the safety of his advances. (b) We next come to the merits of the rayat as an honest debtor. He is in fact a model paymaster: being filled with a religious desire to pay his debts, not only those incurred by himself, but also those incurred by his father and even remoter ancestors. To leave ancestral debts unpaid is in his eyes a shameful thing; it is as though he refused to his father due funeral rites. This strong religious sentiment (may it never grow less!) is indeed the sheet-anchor of the rayat's credit. Moreover, he is by no means wanting in shrewdness, and he feels that for temporal as well as spiritual purposes it would be fatal to repudiate his debts; for who would then be found to trust him? Hence his steady refusal to avail himself of any insolvency law. For example, in the Ahmednagar District, with a rural population of nearly three-quarters of a million, not one rayat, out of the thousands hopelessly involved, was found willing to accept freedom under the special insolvency clauses of the Dekkhan Agriculturists' Relief Act. Two or three were indeed declared insolvents by the Courts, but this supposed benefit was conferred on them in spite of their protestations and even tears. I have myself often seen instances of the same feeling. I was especially struck on one occasion when a number of leading rayats, some three or four hundred, had come together to meet me at Sangamner, a local centre of importance in the Ahmednagar District. I asked them how they liked the operation of the Dekkhan Agriculturists' Relief Act, which had then given a sudden check to all process for the recovery of debt. The answer of the principal raiyat who acted as their spokesman was given in two words (Mahratta): "Sükh jhála"—"we are in comfort." He went on to explain that now their creditors could not harass them with decrees and executions; so they paid the Government assessment out of the crop, and ate the rest themselves. He than again repeated the words, "Sükh jhála." This seemed to me a very dangerous state of things, looking to the precarious position of the Dekkhan peasant when unsupported by the money-lender; so I said, "I am glad to hear that you are in comfort. But how about the saukar's rupees which you have had? Is it the part of honest men to live in comfort when their debts are unpaid?" To this there was an immediate and unanimous answer in the negative, not only from the spokesman but from all those present. Many of them stood up, saying "No! No! it is not honest. We wish to pay our debts. But we have been oppressed by our creditors, and we do not know how much we really owe them." They then went on to ask that Government should make inquiry and ascertain the true amount of the debts, and whatever that was they would pay it. On this point they were quite vehement, saying: "Allow us and our children dry bread to eat and a cloth to wear, and give everything else to our creditors until our debts are paid." Afterwards they handed me a written proposal to the same effect, which I sent on to Government. I think gentlemen present who have experience of the Indian peasantry will bear me out in saying that a feeling of this kind is very universal, and that the rayat is an honest debtor who is willing to pay if he has the means. (c) And if on the one-hand the rayat, on account of his hereditary instincts, is a satisfactory debtor, so on the other hand in the hereditary trading class of India, we find ready an unrivalled agency for the distribution and collection of loans. At present the actual money-lending business of the Dekkhan is in the hands of native saukars, chiefly Marwadis. These local capitalists thoroughly understand their business; in each village they can tell you to a nicety the means and character of the individual rayats; and they are very shrewd, patient, and economical in their management. In starting an Agricultural Bank it would be fatal to take up a position of antagonism to this capable and influential class. If it is to be a commercial success a bank must secure their co-operation: bringing them in as shareholders, depositors, agents, and brokers; and making it advantageous for them to join heartily in the scheme, and to bring to the bank a portion of their business connection and good-will. The object is not to subvert or set aside the existing machinery for the distribution of agricultural capital, but to organise and regulate it. And I am glad to say that as regards the Dekkhan Districts, we have every reason to be satisfied with the friendly inclination of the local capitalists. Indeed, as already shown, they have actually taken the initiative, under the guidance of a few native gentlemen of special intelligence and public spirit. At first they were naturally inclined to doubt the effect which a large new money-lending institution would have on their interests. But they are clear-headed practical men, and soon came to see that it was for their advantage to have a share in a bank which would enjoy special privileges from Government. They also believe that a stimulus will thus be given to the prosperity of the district and to the general trade which is mostly in their hands. I have already described the active steps taken by the Poona Committee, and I understand that about one-half the total capital required has already been offered from the four Dekkhan Districts. On the subject of the facilities for local control and management it is further of importance to note that the bank may rely for efficient help upon the class of Government pensioners, public servants who have retired after a long term of approved service in the revenue, judicial, and other departments. These men are in every way fitted to serve on local boards, from their high character, from the leisure at their command, and from their experience and knowledge of business. (d) The last point noted is, the favourable attitude of Government. It is an old saying that the English capitalist invests his money in every other country of the world in preference to India; and no doubt the distrust of Indian ventures dates from the old times of John Company, when he did not make private enterprise welcome if it appeared in the persons of "interlopers" and "adventurers." Happily this state of things has long ceased to exist. Yet there still seems to survive in financial circles a certain fear of official jealousy. Thus a couple of years ago a gentleman of large financial experience, and himself a Director of the "Credit Foncier Egyptien," wrote to me as follows regarding the present project: "My impression is, from what you and others have told me, that India has all the conditions requisite for the success of a land bank, provided always it can rely on the support or, at any rate, the 'benevolent neutrality' of the Government." Since this was written the Government of India have declared their policy on the question. And we know that they are prepared to go much further than mere "benevolent neutrality." Recognizing the true interests of the State as the general landlord, they offer to undertakings of this kind an active support, administrative, financial, and legislative. And when we remember how all-pervading is the influence of Government in India, we realize how important is the change in the situation when this influence, formerly adverse, is now thrown into the scale in our favour.

When we look upon the other side of the picture, and consider what are the special disadvantages attaching to such an enterprise in India, I do not myself see that, from a banking point of view, there is any real and serious difficulty except that arising from the poverty of the individual rayat and the want of solidity in the security he is able to offer. He is indeed the absolute proprietor of his holding, subject to the payment of the Government assessment; and if this Government demand were either fixed or limited in a definite way, the security would be good; but this is not case, the demand being liable after every 30 years to an enhancement which may swallow up the margin of profit upon which the mortgagee depends. The theory no doubt is that the enhancement will not touch improvements made by the holder, and those who support the existing land system that in practice the demand is not increased except on fair and sufficient grounds. But I feel bound to admit that this view of the case is not accepted either by the rayat himself, or by those would otherwise be willing to invest their savings in land. I make this admission with regret, as being the weak point in the scheme I advocated; but it cannot be denied that the banker must look with distrust on a security the solidity of which depends upon the discretion of the fiscal authorities. Throughout the Dekkhan the original 30 years' leases have within the last few years been falling in, according to the order in which the groups of villages were first settled Thus in Purandar Taluka, where our experiment is to be made, some villages have been re-settled, others are due for revision, while others again will become due within the next few years. This prospect naturally brings uncertainty into any calculations regarding the value of the holder's interest. The Poona Committee have therefore asked that in the area of experiment the existing rates should not be disturbed for a period of twenty years from the present date. The difficulty may thus be dealt with by a simple departmental order, and it is hoped that the Local Government will not object to make this moderate concession which those on the spot consider essential in order that the experiment may have a fair trial. The other difficulties which have from time to time been suggested to me while Agricultural Banks in India have been under discussion, appear to have been all considered and disposed of: the rayat's old encumbrances will be dealt with by a voluntary liquidation under the management of a Statutory Commission; the native money-lenders instead of being hostile have themselves taken a leading part in the movement for the establishment of a bank; the delay, vexation, uncertainty, and expense of collection through the Civil Courts will be replaced by a summary procedure mainly worked by the village officers, and more suited to the simple habits of the rayats, while, instead of the old official obstruction, the undertaking will be supported by the hearty good-

will of the highest authorities. To conclude, I beg to submit that the facts above set forth show that the undertaking rests on a good commercial basis; and I would ask you to encourage the local efforts made in India by securing for the enterprise some active and effectual support in this country.

AGRICULTURAL EDUCATION.

IN these times of proposed agricultural improvements by legislation, the public should not lose sight of another way by which improvement of perhaps a more substantial nature may be brought about—an alteration for the better, which would make the other less necessary. We allude to better training in their respective professions of proprietors, factors, and farmers. A proprietor educated from the time he leaves the nursery at one of the many large public schools, and having bought a right of one of the Universities, by the sweat of his brains for a few years, to write M.A. or B.A. after his name, is no more able to manage his estate than he would be to measure the distance of the sun from the earth without studying mathematics. No doubt his education and associations have made him a gentleman and a British-er of the first water; but we must have more in these times than that, if those happy social relations which have made Britain great are to continue to exist. Such an one too frequently guided by a lawyer-factor, whose training for the very responsible office he is supposed to fill is often even worse than that of his employer. Of course we have a few noble exceptions in both classes, but it is not these who have induced our remarks. The result is the usual one when the blind lead the blind. It becomes a matter of greater interest when we see that this state of things involves not only farmers, but the public generally, in a serious loss. We are loath to admit the fact, on the other hand, that farmers have not been keeping up to the times as to the knowledge of the very essence of their business.

It was good enough to do as their forefathers did, when good honest dung was the only manure applied to crops, and as many pence per annum would have covered the expence of purchased food as it now takes pounds; but it will not do in these days, when farmers have to look to their interests, involving a sum often far greater than their rents against dishonest manure merchants, culpably negligent seed merchants, and chemical quacks. For some, analytical chemists are like other men, and can be bought at a price. We only speak for the few, we hope, very few, of these different classes, but it is usually into such hands that the ignorant fall. No one can read the reports of Dr. Voelcker and Mr. Carruthers, in the last Royal Society's journal, without feeling the truth of our remarks. With all these complications, it is becoming more necessary every day that farmers should educate themselves in the scientific practices of their profession. The absurd notion that 'science' and 'sound practice' in this industry are different things, must die out, and farmers must get to know for themselves in most cases or by the aid of a reliable specialist in a certain few, what is being bought. If a farmer were to go to market to buy a cow, and come home with a bull, because he did not know the one from the other, the act might appear more absurd to farmers, who would all laugh at him; but the mistake would not be greater, and would really cost much less, than that of the man who went to market to buy dissolved bones, and paid £100 for what was said to be such, but which was really dissolved coprolites, mixed with refuse hair, and horn, worth less than £50; or another, who thought he had secured £40 worth of the finest permanent pasture grass seeds, and had only got ryegrass, worth in the open market about £10, and enough weed seeds to keep him in misery for years to come.

Government has of late years begun to do something towards spreading a knowledge of agricultural facts throughout the masses, but as yet all that can be done with present machinery must be very superficial, though in the right direction. We have an agricultural class, subsidized by Government in Edinburgh University, and ably conducted by Prof. Wilson, who is possessed of large and varied experience. Yet we would like to see the Government do more than that. We should like to see a few more colleges on the type of the Royal Agricultural College at Cirencester, but with the staff appointed and paid by the Legislature. It was most unfortunate for the agricultural work that serious mistakes in calculation and management were made in the early days of this college; else we should now have seen the country dotted over with such places, doing an untold good to the community at large. The college was also unfortunate in getting into bad repute through rowdyism on the part of students; and even yet, although no such thing has been experienced for years, we now and then hear the *fama* has not quite died away. A few facts as regards the work and management may not be uninteresting. The institution is entirely self-supporting, having been built by private enterprise. Lectures on agriculture, and the various important allied branches of science, are given by a regular staff of six competent men, besides various auxiliary lecturers who come at intervals. The students, who usually vary in number from 90 to 100, are strongly encouraged to go in for practical work of all kinds, and this is wherein we think the stronghold of the Royal Agricultural College lies. A young man when he leaves school or college is better not to give up all studies which conduce to his culture, although he means to learn to farm as a profession.

The sudden relaxation of strict rule is often too much for the average student. Going on to a farm as a boarder, in the usual way, very generally results in his getting into lazy habits and learning nothing of business, and much that he would in a few years be thankful never to have known. The result is that he goes abroad, having failed to succeed in this country simply because he neither gave himself nor the country a chance. In connection with the college there is a farm of 500 acres, where students are at liberty to assist in work of any kind, and for excellence in which as well as for practical work done at the veterinary hospital and blacksmith and joiner's shops, there are prizes given. These, in a far greater degree than the real value would indicate, encourage in all Englishmen of the right sort a true spirit of healthy rivalry. The college, in short, is one the Government would do well to take a pattern from in many respects. This is shown by the high and yet improving standard of work done, as judged from the results obtained by its students at the two most important recent examinations for the diplomas of the leading English and Scotch agricultural societies, as well as by the largely increasing percentage of passes for the diploma of the college itself, now that the more important subjects are taken by outside examiners.

The Royal Agricultural College has now been before the public for many years, and its rules and management have been discussed from time to time in the columns of some of our contemporaries. These regulations have not always appeared in a favourable light. It must be fresh in the minds of many that very disastrous consequences, to the college itself and to agricultural teaching generally, resulted from the removal of Professor Church, by an arbitrary edict of the Principal, who, according to the rules still existing, has such power of removal. We are glad to know that, under a new Principal, matters go harmoniously with both staff and students; still, we can't help thinking that the appointment should be of more certain tenure. Many former Professors now occupy important positions in the scientific world, and several of the present staff are men of position and ability. If our hopes, that like institutions to this (which has done such good work in the past, and is now, as we have shown, exhibiting increased activity and usefulness), may be founded under Government auspices, should be realized, they may profit by its experience, and frame such a constitution as will work without any possible friction for the good of the cause of increased agricultural education. Most of our readers must be aware that we are likely before long to have a Minister of Agriculture. We hope that one of his prominent functions, or of the officials of the Board of Trade appointed to look after the interests of agriculture, will be to look over agricultural education in all its branches; for, as we stated in our opening remarks, we are confident it is largely by the better education of all the different classes that have to do with land that British agriculture is again to take the position that it ought to occupy in the eyes of the civilized world.—*North British Agriculturist.*

THE ROYAL AGRICULTURAL COLLEGE.

SITUATED near the noble Oakley Park, the seat of Lord Bathurst at Cirencester, Gloucestershire, is a stately Gothic building, standing in the midst of the "College Farm," a mile and-a-quarter from the town of Cirencester, and in the vicinity of the picturesque Stroud valley. This is the Royal Agricultural College, in which so many of the leading agriculturists of the present day have been trained, and in which are at present a number of students who are quite up to the standard of former years. To this establishment I wended my way on July 23rd, with the intention of seeing what facilities are afforded for the training of students, especially young men from India or who are destined to be employed in India. When I was at Cirencester five years ago, the Rev. Mr. Constable was Principal of the College, but he left in 1879 and the reign of the Rev. John B. M'Clellan, M.A., Double First Classman in Honours, and late Fellow of Trinity College, Cambridge, commenced at the beginning of 1880. To this courteous gentleman's management must, I believe, be attributed much of the success and many of the improvements which have marked the history of the College during the past three years. To him and his assistants and pupils I am indebted for much of the information I give here. It was 2 P.M., when I reached the "R. A. C.," and some of the students, who had been working during the morning, were just starting tennis, cricket, and other games, on the well-kept lawns. Others were still at work in the College, but most of the work is done in the morning. The teaching staff is at present very strong; in this direction there has been much improvement during Mr. M'Clellan's principal-ship, resulting in an increase in the number of students. There are now about 90 students, including six natives of India. The professors and instructors include such men as Prof. H. J. Little, M.C.R.A.S.E.; Prof. R. Wallace, F.H.A.S. Agric. Gold Medallist Edin., Diploma R.A.S.E.; Mr. Russell Swanwick, M.R.A.C.; Prof. E. Kinch, F.C.S., F.I.C.; Prof. Allen Harker, F.L.S.; Miss E. A. Ormerod, F.M.S., Consulting Entomologist to the Royal Agricultural Society; Prof. H. Ohm, M.A., F.M.S.; Prof. A. W. Thomson, C.E., B.S.C., Prof. W. F. Garside, M.R.C.V.S.; Prof. Fawcett, B.L; Dr. Augustus Voelcker, F.R.S., &c. These, with other competent gentlemen not employed upon the regular staff of the College, form the Board of Studies. The College, with a large mixed farm attached for practical instruction, was established in 1845 under the patronage of H. R. H. the late Prince Consort, with the support of a number of the nobility and gentlemen interested in agriculture from all parts of the kingdom, "for encouraging and supporting the study of agriculture." Under its Royal Charter it has six residentiary professorial chairs, and grants certificates of proficiency and a diploma of membership and associateship. In 1870, a supplemental charter with new powers was obtained, and in March, 1880, her Majesty was graciously pleased to command that the College be styled the Royal Agricultural College. The object of the institution, in the words of its Charter of Incorporation, is, by combination of College and Farm,

"to teach the science of agriculture, the various sciences connected therewith, and the practical application thereof in the cultivation of the soil, and the rearing and management of stock:" in other words, by teaching the scientific principles which necessarily govern agricultural operations in all parts of the world, together with the methods and processes of sound agricultural practice, to furnish the most efficient training for the profession or business of an agriculturist, whether at Home, in India, or in the Colonies,—a training, that is to say, which shall be expressly suited to the needs and requirements of the following classes:—intending landowners or occupiers; intending land agents or surveyors, land stewards, factors, or managers of estates; intending colonist *employés* in Indian agriculture, forestry, &c. In addition, however, to affording the best scientific and practical education for all such requirements, the College offers to its students many of the general advantages of a University course. As the institution has a special interest for Indian readers, and will probably be the training ground for some of the Indians and Anglo-Indians of the future, I shall briefly refer to some of the principal features of the College, in order that your readers may form a fair idea of its capabilities.

The *Chapel* is a neat Gothic structure, and is furnished with an organ, and a reredos erected in memory of the Rev. Principal Haygarth. The *Library* contains several hundred volumes, chiefly of the best works on agriculture and the allied sciences, and works of reference. The *Reading Rooms* are furnished with daily and weekly newspapers, general and scientific, and the leading agricultural periodicals, including one or two from India. There is a *Museum* divided into special departments for the illustration of farm produce, agricultural chemistry, natural history, geology, botany, building, veterinary science, &c. A considerable space of ground is allotted for the *Botanic Garden*, which is an adjunct of great value to the College for practical instruction in the botany of agriculture and arboriculture, and various experiments in vegetable physiology. It is divided into numerous plots occupied by representatives of the natural orders, grasses and other agricultural and economic plants, and studded with numerous specimens of shrubs and trees of British and foreign origin. To me this was one of the most interesting parts of the establishment. Here lectures are given upon the spot, with the subjects of the lecture growing before the students' eyes; a plan infinitely superior to teaching from mere books and drawings. The *Lecture Theatre* is a lofty hall of large dimensions, with tiers of desks capable of accommodating nearly 100 students. In addition to the lecture theatre there are several excellent class rooms appropriated to the lectures of the various professors; and the Library and Dining-room are also used, as required, for the same purposes. On the walls of the Dining-room I noticed a list of Members of the College, by Diploma (M.R.A.C.). This list comprises only those students who have graduated in Honours. It is, perhaps, the best recommendation the College could possess; such names as the following I noticed there:—Henry Tanner, F.C.S. (1847), author of many text books on agriculture and now an Examiner in agriculture at South Kensington; John Coleman, now an Assistant Royal Commissioner on Agriculture; W. R. Robertson (1863), now Agricultural Reporter to the Government of Madras; Charles Benson, Assistant Manager of the Government Experimental Farms, Madras; C. E. M. Russell (1876), Superintendent of Forests and Government Farms, Mysore; Kumar G. Narayan (1880), of the family of H. H. the Maharajah of Cooch Behar, Bengal, the first native Indian who obtained the diploma; C. E. O. Wilkinson (1882), Agricultural Director of Estates to H. E. the Nawab of Hyderabad; and E. C. Ozanne (1883), Director of Agriculture, Bombay. In the same year as Mr. Robertson obtained his diploma, Professor Wrightson, F.C.S., Professor of Agriculture at South Kensington, obtained his diploma. In April last, two natives of Bengal, Ambika C. Sen, M.A., and Syed S. Hosein, B.A., obtained diplomas, the former having received the highest number of marks ever given to any student in the College; the latter was only third on the list, Mr. Ozanne being second. The chemical, physical, and biological laboratories are well-fitted with all necessary appliances. The biological laboratory was added in 1881, and is in charge of Professor Harker. It is fitted up after the most approved models, and supplied with efficient microscopes and the necessary instruments, and re-agents for dissections and minute examinations of plants and animals. The *Mail* has on more than one occasion recently advocated the extension of a knowledge of veterinary science in India, and I was pleased to hear that two prizes for veterinary science, one of £50, and the other of £20, are annually awarded to the Bengal Agricultural scholars by the Bengal Government at the final examination. The *Veterinary Hospital* at the College is fitted up with boxes for the reception of diseased or injured horses, with yards and sheds attached for sick cattle and other stock, examination house, pharmacy, and shed for *post-mortem* examinations. The *College Farm* contains about 500 acres, divided into 20 fields, occupied and worked by a former Honour student and Member of the College,—Mr. Russell Sanwick,—who has achieved a high reputation in agricultural circles. I could not see the best of the stock, as they were at the York Agricultural Show. Mr. Swanwick has taken over 300 prizes for his cattle, sheep, pigs, &c.

Of general description I have given enough, I believe, to show that the Royal Agricultural College is admirably adapted for teaching natives of India and others the scientific principles which necessarily govern agricultural operations. In the Report of the Special Committee to the Agricultural Society of Scotland last year, it was stated that "agriculture is now a science, or rather the application of a number of sciences, and requires as wide a range of scientific knowledge as any learned profession. . . . . Nothing but a College specially organised and equipped for the training of agriculturists is capable of affording the means of acquiring the knowledge which is now necessary to the proper understanding of the scientific principles upon which the varied practice of agriculture rests." And now to mention a few items I obtained from the worthy Principal of the College. Questioned as to the Indian students, he produced a photograph of six natives, four of whom were from Bengal, selected by the Bengal Government; one was from Oude, his expenses being paid by the Government of the N.-W. Provinces. There was one who paid his own expenses. All had worked well, and two had left last April. There are now six Indian students, and two more are expected from Bengal soon. The Indians are out-students, and therefore do not take their meals with the rest of the students. They are very studious, and as a rule do not join in the games in which the Europeans indulge. As I expected, they do not, as some of the Europeans do, enter ploughing matches and other competitions where the students undertake the actual working operations on small patches of land in order to know by experience what work the farm labourer has to do and how he should do it. About eight months ago, H. E. the Nawab of Hyderabad, with his suite, visited the College, and was so much pleased with what he saw that he observed that he should like to spend a few months at the College as a student, but he had not time to do so. "However," he went on to say, "seeing that I cannot stay here, perhaps you can send out one of your diplomaed students to take charge of my estates, and teach the natives how to till their soil better than they do at present." The Nawab remarked that he hoped that Hyderabad scholarships would eventually be established. It was arranged that Mr. C. E. O. Wilkinson, who took his diploma last year, and who is related to Sir Bartle Frere, should go to Hyderabad as Agricultural Director of the Nawab's estates. The last advices from Mr. Wilkinson were favourable. At the close of last year Colonel Pearson, the English Director of the Forestry School at Nancy, France, where many of the Indian forest officers are trained, visited the Royal Agricultural College in order to ascertain what facilities are afforded for the study of forestry, as it is probable that at no distant date the forest officers destined for India will be trained in England. An application was sent to the Government by the R. A. C. authorities with a view to this College being utilised for the purpose, and it was pointed out that there are large woods of various kinds close to the Royal Agricultural College, belonging to Lord Bathurst where all the operations of forestry are carried on. In the forest of Dean (1½ hour from Cirencester by rail) are some of the finest oak forests in the country, so that on the whole this College would be a very good establishment for the purpose I have named. However, a final decision has not yet been arrived at, there being one or two other Colleges where it is said facilities are offered for teaching forestry; Cooper's Hill College being one of them. There are at present some Indian Civil Servants studying at the R. A. College, and one of the professors assured me that "one of our best men is Mr. Keess, the son of an Indian General." The Principal said, "We have had many nationalities represented here since I have been here; we have had men from India, Greece, Italy, Brazil, France, Egypt, Channel Islands; English, Scotch, and Irish." The late Duke of Marlborough had been President of the College for several years. He will be succeeded by the Duke of Richmond and Gordon, K.G. H. R. H. the Prince of Wales is patron, and the Committee of Management includes such landed proprietors and agriculturists as the Earl of Ducie, the Earl Bathurst, Sir Michael E. Hicks-Beach, Colonel Kingscote, Professor Story Maskelyne, and the Hon. Lord Lyttelton. I cannot conclude this notice of a most interesting educational institution—which all Anglo-Indians at home on furlough would do well to visit—without mentioning the *Agricultural Students' Gazette*, edited by students at the College. In the number for July 1882, I find an article by Professor Kinch, on the Soy Bean, which attracted considerable attention in India last year.—*Madras Mail.*

AGRICULTURAL EXPERIMENTS IN SUSSEX.

THE experiments conducted at four different stations—representing different soils—during the past year by the Sussex Association for the Improvement of Agriculture have, according to the report presented by Mr. Thomas Jamieson, chemist to the association, yielded some interesting results. To the surprise of wondering farmers, the barren clay of an abandoned field near Haywards Heath has been made, under the fertilizing influence of a suitably combined manure, to give forth a remunerative harvest, and, moreover, valuable knowledge has been obtained on more than one important scientific point. In broad outline the experiments have confirmed the familiar rule that to produce cereal crops, nitrogenous fertilizers are indispensable; to produce roots, phosphatic. For the enforcement of this principle Mr. Jamieson judges even the varied manurial riches of that standard fertilizer, farmyard manure, insufficient. Both at Billingshurst and at Haywards Heath experience has taught him that even a heavy dose of farmyard manure, unaccompanied by artificial fertilizers, cannot supply *all* that is wanted, and that an addition of the special substances affected by the several crops adds to the value of the harvest out of proportion to the outlay. It is, on the other hand, quite practicable to supply all the constituents wanted for plant food economically by means of artificial manure alone. Among nitrogenous manures nitrate of soda has, in the past year—possibly owing to atmospheric conditions—carried off the palm. Mr. Jamieson, who wages war most unceremoniously upon various accepted beliefs, protests against the opinion that nitrate exhausts the soil. Add what else is wanted, he says, and the exhaustion

will be *nil*. He is not careful to appraise nitrogenous manures otherwise than according to their wealth in nitrogen—with this proviso only, that some, as, for instance, sulphate and guano, may under circumstances act to a certain extent injuriously owing to the presence, or generation, of acid. At Hassocks Gate, Mr. Jamieson observed that the sulphuric acid, liberated from a dressing of sulphate of ammonia, so seriously affected a crop of swedes that they assumed a perfectly red colour, as if exposed to the action of acid vapours. This symptom disappeared upon treatment with a dose of nitrate of soda. As regards phosphatic manures, Mr. Jamieson adheres to his former opinion that—except on chalk—it is perfectly immaterial whether the phosphate be applied in a soluble or an insoluble form. Indeed, more favourable results have been obtained from coprolite than from bones. What Mr. Jamieson sets far more store by than solubility is minute pulverisation. His favourite mode of supplying phosphate is in the shape of a mixture of steamed bone-flour and finely-ground coprolite, a moiety of the phosphorus being allotted to each. On chalk soil, such as that at Preston Park, dissolved bones have produced the best result. Nevertheless, the deficiency of phosphorus in the manurial dressings, purposely left deficient in one substance or other, shows a less marked effect on this very soil, which fact Mr. Jamieson attributes to the presence of more 'available' natural phosphorous in chalk. That phosphatic manures, whether animal or mineral, soluble or insoluble, do not exhaust their effect in the first year, is amply proved by a series of experiments with swedes made at Hassocks Gate, where the difference in the crop on various plots is very marked, accodring to the dressing applied in the preceding year. The potash experiments plainly indicate the peculiar value of potash as manure on certain soils. One main feature apparent in the results is the injurious effect produced by the chlorine of muriate of potash. For agricultural purposes potassi-chloride has never stood very high in popular estimation. But the ground for this was previously its extreme solubility. Mr. Jamieson taxes it with the exhalation of chlorine, under the influence of which the plants sicken and grow wan and pale. He has remarked—without being able to suggest an explanation—that in soils rich in black vegetable matter—humus—this baneful effect is to a large extent neutralized, as is also the detrimental action of acid already instanced in the case of nitrogenous manures. To arrive at an explanation, he has instituted several ingenious experiments. Among other things, he has dressed a crop of sickly swedes, labouring under vegetable 'chlorosis,' with dextrine, with the result of producing a strikingly deep green and healthy colour in the leaves of the plants. The plot gained rapidly on its neighbours. But it did not maintain its superiority. Apart from this interesting result the question under investigation still remains unsolved. Mr. Jamieson recommends the high-priced nitrate of potash in preference to other potash salts. The deficiency-experiments appear to have raised a doubt in Mr. Jamieson's mind whether the leguminous classes of plants (beans, pease, and clover) really deserve the distinctive name of 'potash plants.' Some of these have thriven where potash was designedly withheld. Similar experiments seem to have satisfied Mr. Jamieson that from the familiar heptade of inorganic elements considered to be indispensable for plant life, sulphur and magnesia may in many cases be eliminated, being present only as accidental admixtures. As a useful wheat manure for Sussex, Mr. Jamieson recommends (duly guarding himself against application to every soil)—(1) as autumn dressing—2½ cwt. of sulphate of potash, ½ cwt. of sulphate of lime (or in substitution of both, 1 cwt. of ground kainite), 3 cwt. ground coprolite flour, ½ cwt. steamed bone flour, and 1½ cwt. nitrate of soda; (2) as spring dressing—½ cwt. sulphate of potash, ½ cwt. mineral superphosphate, ½ cwt. steamed bone flour, 1½ cwt. nitrate of soda. The mixtures are calculated per acre. As a good root manure Mr. Jamieson recommends 2½ cwt. coprolite flour, ½ cwt. steamed bone flour, ½ cwt. nitrate soda, ½ cwt. sulphate of ammonia, ½ cwt. horn-dust or dried blood, and 2 cwt. ground kainite.

The experiments will be continued in the present year. The committee have assented to Mr. Jamieson's proposal, according to which the root plots will be cropped with mangolds, without manure, to show the lasting effect of manures already applied; wheat will be grown on the same plots, with 'soil-exhausting' manures; beyond this, some interesting experiments will be made at Hassocks' Gate to elucidate the question of mineral ingredients absolutely essential to plant growth.—*Sussex Advertiser.*

NOTES ON POULTRY-KEEPING.

IOOD.

NO doubt, what constitutes the greatest cost in a poultry-yard is the daily food, and we must not be blind to the fact that, if left in the hands of unskilful people, the owner soon finds out the enormous expense to which he has been put, so much so, that we have often heard the remark that after paying high prices for grain, the eggs they receive in return cost them each the same price that would be paid for a dozen, if judiciously managed.

The feeding of poultry is a very simple, but not always an easy, problem. The expense of building fowl-houses and other accesories is known; whether they be costly or insignificant, they represent capital which in time brings forth fruit; but a daily food is a problem which must be solved at every moment, and, if badly solved, it misleads, and the misleading carries you on to losses which increase daily.

There is no living creature of the animal kingdom in respect of feeding that possesses such a multiplicity and variety of taste as the cock and hen. They are granivorous, herbivorous, carnivorous, vermivorous, and insectivorous; they feed without distinction upon everything that is offered; they refuse nothing. With such a conformity of stomach open to receive substances so diversified, we must admit there is a large margin; moreover, whatever the ingredients, they thrive upon them, they prosper, and the aim of the owner is obtained by getting the most satisfactory result.

But the result can only be obtained by judicious feeding. If fowls are only allowed to eat what they can pick up, it would be a very poor one, unless they have the run of a stackyard at harvest time, when one need not trouble much about them; but in every other season of the year they must be attended to night and morning. Another important point is to know what a hen can eat so as to satisfy her hunger and keep her in good condition; this is a great consideration, which must not be acted upon at a guess, for on the proper quantity depends the whole success of the undertaking; in fact, it is the turning point. If too much food is given, it turns to plethora and manure; the hen under these circumstances becomes almost sterile, and if she does lay it is only at rare intervals. If not food enough, the hen, not finding sufficient nutriment for her own subsistence, cannot produce either eggs or flesh. The result would be *nil* in both cases. To obviate this, a medium must be found by which surplus fat is avoided on the one side, and on the other to prevent the loss of flesh necessary for her maintenance as a producer.

A practical farmer in France, Monsieur François Routillet, the author of a book on poultry, asserts that a hen having liberty to roam about requires 120 grammes (4¼ oz.) of corn per diem, and a hen in confinement requires 60 grammes more, or 180 grammes (6¼ oz.) On the other hand, Monsieur Mariot Didieux, who has published a work in two volumes on the same subject, maintains that with 60 grammes of oats (2⅛ oz.) a hen of moderate size can be amply fed. The same author even goes further, and says that 45 grammes of buckwheat (1½ oz.) is sufficient to keep a hen in good condition as a producer. There is evidently some error, as there is an enormous difference in the estimation of those two gentlemen, which is far too great for any poultry-keeper to act upon.

To set at rest this question, a Belgian nobleman, a student of natural history in general, and of poultry in particular, has put to the test the remarks made by the above authors, and it is only by experiments on different subjects that this problem of feeding poultry has been solved in a satisfactory manner, as being the master-mover of a profitable poultry-yard. For that purpose, three lots of hens, of ordinary size and of the common sort, were chosen. Each lot, composed of ten hens, was confined during a month in runs about 20 to 22 yards of area. The first lot was exclusively fed on barley, the second on buckwheat, and the third on oats. To each of these three lots 1000 grammes, or 1 kilogramme (about 2¼ lbs), of these different grains were given each day. On making up the three lots, each was put into the scales; the first lot weighed 18 kilos (39⅝ lbs.), the second 17½ kilos (38½ lbs.), the third 18½ kilos (40¾ lbs.). At the end of the month they were again weighed, and the following is the result:—The first 40⅝ lbs., the second 38½ lbs., and the third 39½ lbs.; so that it is pretty certain that the food given was sufficient to keep them in good condition.

We see that oats proved to be less nutritive than the other grain, still the hens were satisfied with the portion they had. We may remark that these hens were confined so that they were obliged to feed exclusively on grain, thereby debarred from picking up any extras; then, taking into consideration what they find when at liberty, we may fairly argue that 75 grammes, or 2⅝ oz. of grain, are suficient for each head of poultry daily, being a very liberal allowance.

Having established the quantity required for each fowl, the breeder can easily count his cost on the one hand and his receipts on the other. In case grain is too dear, which may happen, there are other means at times very economical—take, for instance, the potato. This is very suitable to hens when boiled and given to them hot; it assists the laying to a great extent; but bearing in mind the profit the farmer is to derive from his yard, potatoes must be cheap, otherwise he must seek other substitutes.

Beetroot, turnips, carrots, &c., boiled and mixed with bran or middlings, is a very excellent food for fowls: but if fed solely on grain, grass, and vegetables, the hen would drag on her existence, but would be neither a good layer nor a good sitter. A hen requires food of a stimulating nature. As we have said before, she is granivorous, herbivorous, carnivorous, &c.; she eats all these subtances; she digests them all, however hard they might be; her digestive organs are so constructed that in her ejections no particle of grain or other substance is seen. She is very fond of meat, which is very easily digested; even particles of bones remain in the stomach until thoroughly digested, and are ejected in the same state as other food.

The hen being carnivorous, flesh or meat is then one of the constituent parts of her food. A farmer can always obtain horse-flesh or inwards of animals at a very moderate rate, which being boiled and cut up, and given in the same quantity as grain, will always keep fowls in the best of order. The hen, as a vermivorous bird, is always seeking after worms and insects, and they have a great affection for larvæ and chrysalis, which they seek all day during the whole of the warm weather; but in late autumn, or in winter, when it is difficult to obtain them through their own exertions, farmers ought to assist them by establishing 'verminieres,' or 'vermination beds,' by which larvæ, &c., can be easily produced in large quantities, and which would prove a very great boon to poultry, at a mere nominal price.

In our next chapter we will give a description of a 'verminiere.'

C. W.

—*North British Advertiser.*]

THE NECESSITIES FOR JUMING.

IT is now many years since Government, seeing the waste of forest caused by juming, endeavoured to put a stop to the practice by pointing out to its officers the desirability of putting some sort of pressure on those who pursued this "wasteful and vagrant custom," as it was called.

Near Darjeeling, Sir Ashley Eden had hopes of producing some effect, by summoning the chiefs of those communities that jumed, and having its desire explained to them.

In vain the chiefs urged the impossibility of confining their people to one plot of ground, but seeing Government determined, they promised to do all they could.

Some two years after, it was officially recognized that the custom was not in the slightest degree abated. The people jumed as before, regardless of the orders. On looking into the matter, it is noteworthy that the custom is extremely old, and evidently preceded the Aryan irruption into India by which the plough was introduced, and that juming despite a few exceptions is in India a race character of the great non-Aryan group. It appears pretty clear that in pre-Aryan times the country was covered by a huge tropical forest, jumed everywhere by the indigenous races called by the Aryans demons.

Thus the custom is actually older than the languages and physique we now see among the non-Aryan hill tribes, who have been driven from the plains, and have since largely differentiated.

Neither the plough nor the hoe are non-Aryan implements, and were they abolished, juming is the only alternative. Human customs are often unaccountably persistent, even after the causes are removed, but to understand juming, let us examine it where the custom is still a necessity, and where indeed it is a far more laborious system of cultivation than by plough or hoe. Taking the Noga* hills, as a good example, we generally see tribes, villages, or communities owning and cropping in rotation an area from six to ten times that needed for a year's crop.

The hills around are seen in various stages of forest growth, or grass, where crops have been last taken off. It is also found on enquiry that each family has its land carefully marked out by stones, ridges or gullies, on each of some six or eight different sites, on the hill slopes around, and that are jumed in rotation.

This year's jume may be due east, last year west, and the year before to the south, and so on, a new site being cleared each year, and at first put under root crops, &c., called "No erra," the second year under grain, and called "Heram erra," after which, as a rule, it is thrown up. The various sites are usually, though not invariably, taken in rotation, and when the forest growth is say eight or ten years old. On selection, the men and boys go to it and look up their boundaries, cutting or marking them, and first clear all the undergrowth.

When this is done they fell the trees, leaving and lopping a few where they desire to train their *pan*, *alus*, &c., and cut the rest up so as to lie close, and thus burn thoroughly. After six weeks or so, and when sufficiently dried, it is all fired, giving rise to the huge vertical or columnar clouds with a spreading top so often seen in the hills in spring.

Men, boys, and women then collect the stems, branches, &c., and burn round the stems of any large trees that it may be desirable to kill, or form of the sticks and logs an effectual abbatis to keep out animals.

In this newly cleared land they plant yams, *alus*, cotton, *pan*, *kuchus*, chillies, &c., and it is the "No erra." Last year's clearing is also cleared over by the *dao*, the creeper grass and plants cut down, and fired when dry, and in this they dibble the hill paddy, it is the "*Heram erra*."

As the season advances both sites must be weeded as grass springs up, and as may be supposed the rice gives some trouble being so like grass; a little loop of bamboo, or an iron hoe the size of a table spoon is used in weeding.

The hill paddy is usually weeded three times, and on the hill sides may be seen, here a long line of women and girls, on another slope the men and boys, 10, 20 or 30 in a line, and the work is communistic. Thus one plot of ground gives, the first year root crops, &c.; the second year, hill rice, and is seldom planted the third year, as grasses come up so thickly, especially *ulu* (*Imperata cylindrica*), that rooting and growing underground defies entirely their limited agricultural implement, the *dao*.

In the fourth year, the site is generally dense *ulu*, through which one can only get by paths or on an elephant; here and there tree plants are up, also the larger grasses, as nol, kagra, megolla (*Saccharum spontaneum*,) rising to 20 and 25 feet, (megolla has measured 33,) creepers also appear, and some creeping grasses that rise over the ulu.

In the fifth year tree plants predominate, as there are no jungle fires known in these hills, and at last all trace of the *ulu* has disappeared by the seventh or eighth year, and the site is ready again.

Fire does not kill *ulu*, water and shade are the means most effectual, and hoeing, as a rule, on such slopes is worse than the disease, and the soil at times too stony. The roots or rather rhizome is often a foot deep.

The grasses of Eastern Bengal and Assam are about 170 kinds, and may be roughly grouped by their modes of propagation.

Forest grasses, the seeds of which are at a height to touch *animals* passing, and having spines, hooks, or gum as modes of attachment (when ripe).

Those of the open uncultivated plains, where the *wind* transports them, the minute seed being on a high kalm, and covered by down.

Again, seeds of grasses, that are like grain, and are transported by *birds*, others with light husks by *water*. *Ulu* has a minute seed on a kalm and fine down attached; which enables it to travel long distances, and when once rooted, another and unique mode of propagation at once comes into play, by its rapidly spreading *underground*, among stones and roots, or even to a depth of a foot and 18 inches in clay. It is this peculiarity of a grass, the seeds of which fill the air in myriads and travel immense distances, that lies at the root of the necessity for juming, among most hill tribes to the south and east of Assam, and also the north, where neither hoeing nor ploughing is possible.

Hill soils are proverbially rich, and exhausted soil is certainly not the cause, as we have cases in the adjoining plains where rice has been cropped for 200 years without intermission, or manure. The cure for juming is to introduce some other crop like potatoes and plantains, where a much smaller area will support the same people, where the labour of cultivation can be *concentrated*.

It is highly probable that juming survives in places where there is less need for it than formerly. But to suppress it by law, as a "barbarous system," would entail the necessity of our supporting all the hill people around Assam.

There is generally a good cause for everything; the above is one cause for the necessity of juming.

—*Indian Forester*.]

S. E. PEAL.

Note.—Since writing the above, I see at page 94, Proceedings of the Royal Geographical Society—

"The Tuubunwhas of Borneo live a peaceful rural life, and have no very particular points of interest about them: it is their custom to move from one place to another on the banks of the river, building a very slight house, clearing the ground, and planting, in an idle sort of way, paddy, bananas, Indian corn, sweet potatoes, and the like. Grass sooner or later makes its appearance; very slight attempts are made to keep it down. After a time (generally about three years from clearing) it has gained the upper hand, and the flimsy house about this time usually collapses, and a move is made for a fresh location."

* The name is Noga, from Nok, and not Naga.

WOBURN CROP EXPERIMENTS.

A LARGE gathering of agriculturists assembled at Woburn the other day, by invitation of the Council of the Royal Agricultural Society, to make the annual inspection of the field experiments which are being conducted on a farm set apart for the purpose by the Duke of Bedford. General approval was expressed as to the manner in which the cultivation and management of the crops and the preparation of the farmyard manure are being carried on, and the present appearance of the numerous plots displays a satisfactory growth, the differences in luxuriance and vigour of the variously manured wheats and barleys amply confirming to the eye the evidence reported of the almost invariable results during several harvests from each order of manurial treatment adopted.

The primary object was to ascertain by practical trials made under conditions of scientific exactness, what are the relative values of manure obtained from the consumption of different articles of food by animals. Accordingly, the farmyard manure used is prepared in three different ways—one portion by giving the cattle decorticated cotton-cake, which is very rich in nitrogenous constituents, and is, therefore, estimated to yield a manure of high value; another portion by giving maize-meal, which is estimated to yield a manure of low value; and a third portion is prepared without any such purchased food, all the lots of cattle being fed with similar quantities of roots, chaff, and straw. For the purpose of comparing the effects of the food-prepared manure with those of artificial manure, parts of the crops are dressed with nitrogen, potash, phosphoric acid, and other chemicals, equivalent to the constituents contained in the cotton-cake and maize-meal respectively. The rotation known as the four-course shift is followed upon an area of 16 acres. Four acres of mangolds or swedes are grown with four different manurings—namely, one acre with cake-dung, one acre with maize-dung, one acre without dung from purchased food, but with artificial manure corresponding to the cake manure, and one acre also without dung from purchased food, but with artificial manure corresponding to the maize manure. There are four acres of barley following the mangolds, there are four acres of seeds following the barley, and four acres of wheat following the seeds. The seeds are fed off by sheep, part supplied with cotton-cake, part supplied with maize-meal, and part receiving no food but the herbage, and the increase in live weight in each case is noted. The value of taking a fourth part of the land under each crop, instead of the whole under roots one year, barley the next, all seeds the next, and all in wheat in the fourth year, is that a fairer average of results can be arrived at when all the experiments are made in every season as a year favourable to one of the kinds of manurial treatment might chance to be unfavourable to another.

The following table shows the general results of six years' experiments with the roots:—

Weight of Roots.

In the year.	Acre manured from roots, chaff, straw, and 1000 lbs. cotton-cake.		Acre manured from roots, chaff, straw, and 1000 lbs. maize-meal.		Acre manured from roots, chaff, straw, and artificial manures equivalent to cotton-cake.		Acre manured from roots, chaff, straw, and artificial manures equivalent to maize-meal.	
	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.
1877 ...	3	17	2	1	7	4	3	16
1878 ...	13	2	11	16	18	13	12	15
1879 ...	4	10	4	9	7	19	5	15
1880 ...	19	10	18	19	24	10	20	18
1881 ...	22	5	21	14	24	7	21	13
1882 ...	17	6	17	1	19	13	18	3
Average ...	13	8	12	13	17	1	13	16

The average of six years' experiments comes out somewhat in favour of cotton-cake dung over maize-mealdung; but the estimate of agricultural chemists that the manurial residue left from feeding cotton-cake greatly exceeds that from maize-meal is not borne out at all. In fact, in the last two years the results from both were very nearly identical. Artificials reckoned as equivalent to the actual *residuum* from the food are more effective than chemical calculation allows for.

For five years' trial of barley on the same acres in each year following the roots, the results, as far as bushel measures are concerned, appear thus:—

Produce of Barley after Roots.

In the Year.	Acre after roots from cotton-cake manure.	Acre after roots from maize-meal manure.	Acre after roots from artificials equal to cotton cake manure—the barley top-dressed with artificials	Acre after roots from artificials equal to maize-meal manure.
	Bushels.	Bushels.	Bushels.	Bushels.
1878 ...	41·3	38·8	51·4	36·4
1879 ...	38·0	40·6	45 7	32·8
1880 ...	41·3	37·0	41·0	33·4
1881 ...	50·6	47·3	51·0	51·0
1882 ...	51·3	48·1	46·6	46·3
Average ...	44·5	42·7	47·1	40·0

The cotton-cake manure plots gave an average of 44½ bushels, against 42⅔ bushels from the maize-meal manure plots. The yield from the artificial manure plots was still greater, where the constituents equivalent to cotton-cake manure, and also an extra dose of artificial were applied, but considerably smaller where only constituents equivalent to maize meal manure were applied.

After barley come seeds, each acre fed off by ten sheep—one lot supplied with cotton-cake, one with the same weight of maize-meal, and the sheep on the remaining two acres receiving no other food than the herbage. The average increase in live weight of the several lots of sheep, as repeated for six seasons, appears as follows:—

Increase in Live Weight of Sheep Grazing Seeds after Barley.

In the Year.	Increase in live weight of 10 sheep on one acre of seeds, having 728 lbs. of cotton-cake.	Increase in live weight of 10 sheep on one acre of seeds, having 728 lbs. of maize-meal.	Increase in live weight of 10 sheep on one acre of seeds, without other food.	Increase in live weight of 10 sheep on one acre of seeds, without other food.
	Lbs.	Lbs.	Lbs.	Lbs.
1877 ...	303	275	214	210
1878 ...	447	444	392	326
1879 ...	328	435	314	250
1880 ...	262	317	220	314
1881 ...	484	352	134	168
1882 ...	345	402	109	116
Average ...	362	371	245	231

Here the cotton-cake feeding did not tell so well as the feeding on an equal quantity of maize-meal; and in both cases, of course, the increase in live weight was very much less when the animals got no artificial food. The object, however, was to try the effect upon the subsequent wheat crop. The average results for five years, so far as bushels of dressed corn are concerned, are these:—

Produce of Wheat after Seeds.

In the Year.	Acre after seeds fed off by sheep, with 728 lbs. cotton-cake.	Acre after seeds fed off by sheep, with 728 lbs. maize-meal.	Acre after seeds fed off by sheep, without cake or corn—the wheat top dressed with artificial manure equivalent to cotton-cake.	Acre after seeds fed off by sheep, without cake or corn—the wheat top-dressed with artificial manure equivalent to maize-meal.
	Bushels.	Bushels.	Bushels.	Bushels.
1878 ...	41·	43·5	50·6	39·4
1879 ...	39·8	40·	42·7	41·7
1880 ...	22·7	26·2	21·9	25·1
1881 ...	56·4	57·4	58·9	55·3
1882 ...	42·8	43·3	42·1	46·1
Average ...	40·5	42·1	43·3	41·5

The influence of season appears more powerful than the manurial treatment, as fairly uniform differences occurred in the yield between one harvest and another. The averages show a better result from the residual manure of the maize-feeding than from the residual manure of the cotton-cake feeding—a demonstration completely opposed to the teaching of the agricultural chemists, as founded upon analyses of feeding stuffs.

STERILITY OF ANIMALS IN CONFINEMENT.

An interesting department of the sterility of animals is that which results from confinement. This seems specially to affect what are vaguely designated the noble animals. Those which are sterile show great variations; some disdain to cohabit or have lost sexual desire; others have increase of sexual appetite, and cohabit freely or excessively, but without impregnation resulting, or with the result very rarely following. Some, if impregnated, bring forth only abortions, or young which are dead-born, or, if alive, feeble and ill-formed. There is, for instance, as Shorthouse has pointed out, a common occurrence of cleft palate in the lion's cubs born in the Zoological Gardens.

Among birds in confinement there are many good examples of change of sexual habits and of sterility. In some cases they have no eggs, or, if they produce, they have only comparatively few, or they may neglect the eggs when produced, or the eggs duly cared for may be incapable of being hatched. This abortional sterility, arising from imperfection of eggs as a result of confinement, is well proved by experiments made in France on the common fowl. When these birds were allowed considerable freedom, 20 per cent of the eggs failed to be hatched; when less freedom was allowed, 40 per cent failed; when closely confined, 60 per cent were not hatched.

The power of temperatures that are not according to an animal's nature to induce sterility is no doubt very great. Darwin mentions that Mr. Miller, a former superintendent of the Zoological Gardens, believes that the sterility of the carnivora there was increased by increase of exposure to air and cold. In winter inadequately sheltered cows either ceased to give milk or gave it in diminished quantity. "And" says Spencer, "though giving milk is not the same thing as bearing a young one, yet, as milk is part of the material from which a young one is built up, it is part of the outlay for reproductive purposes, and diminution of it is a loss of reproductive power." Failure to maintain the cow's heat may entail such reduction in the supply of milk as to cause the death of the calf. Hard living, says Darwin, retards the period at which animals conceive, for it has been found disadvantageous in the northern Highlands of Scotland to allow cows to bear calves before they are four years old. Roulin found that in the hot valleys of the Equatorial Cordilleras sheep were not fully fecund.

The common fowl will not breed in Greenland or Northern Siberia. "In this country, it is fed," says Spencer, "through the cold months, but, nevertheless, in midwinter it either wholly leaves off laying or lays very sparingly. And then we have the further evidence that if it lays sparingly, it does so only on condition that the heat, as well as the food, is artificially maintained. Hens lay in cold weather only when they are kept warm, to which fact may be added the kindred one, that when pigeons receive artificial heat, they not only continue to hatch longer in autumn, but will recommence in spring sooner than they would otherwise do."

On the subject of the interbreeding of animals, there is a vast body of opinion as well as of facts showing its power in producing monstrosity and its ally, sterility. "If we were," says Darwin, "to pair brothers and sisters in the case of any pure animal, which from any cause had the least tendency to sterility, the breed would assuredly be lost in a few generations." Elsewhere he shows that "long-continued close interbreeding between the nearest relations diminishes the constitutional vigour, size, and

fertility of the offspring, and occasionally leads to malformations, but not necessarily to general deterioration of form or structure. This failure of fertility shows that the evil results of interbreeding are independent of the augmentation of morbid tendencies common to both parents, though this augmentation no doubt is often highly injurious. Our belief that evil follows from close interbreeding rests, to a large extent, on the experience of practical breeders, especially of those who have seen many animals of the kind which can be propagated quickly; but it likewise rests on several carefully recorded experiments. With some animals close interbreeding may be carried on for a long period with impunity by the selection of the most vigorous and healthy individuals; but, sooner or later, evil follows. The evil, however, comes on so slowly and gradually that it easily escapes observation, but can be recognised by the almost instantaneous manner in which size, constitutional vigour, and fertility are regained when animals that have long been interbred are crossed with a distinct family."

Regarding the very remarkable subject of sterility of sexual connection with special individuals only, Darwin says:—"It is by no means rare to find certain males and females which will not breed together, though both are known to be perfectly fertile with other males and females. We have no reason to suppose that this is caused by these animals having been subjected to any change in their habits of life. . . . The cause apparently lies in an innate sexual incompatibility of the pair which are matched. Several instances have been communicated to me by Mr. W. C. Spooner (well known for his essay on cross-breeding), by Mr. Eyton, of Eyton, by Mr. Wicksted, and other breeders, and especially by Mr. Waring of Chilsfield, in relation to horses, cattle, pigs, fox-hounds, other dogs, and pigeons. In these cases, females which either previously or subsequently were proved to be fertile, failed to breed with certain males with whom it was particularly desired to match them. A change in the constitution of the female may sometimes have occurred before she was put to the second male, but in other cases the explanation is hardly tenable, for a female known not to be barren has been unsuccessfully paired seven or eight times with the same male likewise known to be perfectly fertile. With cart-mares, which sometimes will not breed with stallions of pure blood, but subsequently have bred with cart stallions, Mr. Spooner is inclined to attribute the failure to the lesser sexual power of the race-horse. But I have heard from the greatest breeder of race horses at the present day, through Mr. Waring, that it frequently occurs with the mare to be put several times during one or two seasons to a particular stallion, of acknowledged power, and yet prove barren, the mare afterwards breeding at once with some other horse. These facts are worth recording, as they show, like so many previous facts, on what slight constitutional differences the fertility of an animal often depends."

Before leaving the subject of the causes of sterility of animals, I quote a passage from Darwin regarding the results of confinement: "Sufficient evidence," says he "has now been advanced to prove that animals, when first confined, are eminently liable to suffer in their reproductive system. We feel at first naturally inclined to attribute the result to loss of health, or at least to loss of vigour; but this view can hardly be admitted when we reflect how healthy, long-lived, and vigorous many animals are under captivity, such as parrots, and hawks when used for hawking, cheetahs when used for hunting, and elephants. The reproductive organs themselves are not diseased, and the diseases from which animals in menageries usually perish are not those which in any way affect their fertility. No domestic animal is more subject to disease than the sheep, yet it is remarkably prolific. The failure of animals to breed under confinement has been sometimes attributed exclusively to a failure in their sexual instinct; this may occasionally come into play, but there is no obvious reason why this instinct should be specially liable to be affected with perfectly tamed animals, except, indeed, indirectly, through the reproductive system itself being disturbed. Moreover, numerous cases have been given of various animals which couple freely under confinement, but never conceive, or, if they conceive and produce young, these are fewer in number than is natural to the species. In the vegetable kingdom instinct of course can play no part, and we shall presently see (he says) that plants, when removed from natural conditions, are affected in nearly the same manner as animals. Change of climate cannot be the cause of the loss of fertility, for, whilst many animals imported into Europe from extremely different climates breed freely, many others when confined in their native land are completely sterile. Change of food cannot be the chief cause, for ostriches, ducks, and many other animals, which must have undergone a great change in this respect, breed freely. Carnivorous birds, when confined, are extremely sterile, whilst most carnivorous animals, except plantigrades, are moderately fertile. Nor can the amount of food be the cause, for a sufficient supply will certainly be given to valuable animals, and there is no reason to suppose that much more food would be given to them than to our choice domestic productions which retain their full fertility. Lastly, we may infer from the case of the elephant, cheetah, various hawks, and of many animals which are allowed to lead an almost free life in their native land, that want of exercise is not the sole cause. It would appear that any change in the habits of life, whatever those habits may be, if great enough, tends to affect, in an inexplicable manner, the powers of reproduction. The result depends more on the constitution of the species than on the nature of the change; for certain whole groups are affected more than others; but exceptions always occur, for some species in the most fertile groups refuse to breed, and some in the most sterile groups breed freely. Those animals which usually breed freely under confinement rarely breed, as I was assured, in the Zoological Gardens, within a year or two after their first importation. When an animal which is generally sterile under confinement happens to breed, the young apparently do not inherit this power; for had this been the case, various quadrupeds and birds which are valuable for exhibition would have become common. Dr. Broca even affirms that many animals in the Jardin des Plantes, after having produced young for three or four successive generations, become sterile; but this may be the result of too close interbreeding. It is a remarkable circumstance that many mammals and birds have produced hybrids under confinement quite as readily as, or even more readily than, they have procreated their own kind. Of this fact many instances have been given, and we are thus reminded of those plants which, when cultivated, refuse to be fertilised by their own pollen, but can easily be fertilized by that of a distinct species. Finally, we must conclude, limited as the conclusion is, that changed conditions of life have an especial power of acting injuriously on the reproductive system. The whole case is quite peculiar, for those organs, though not diseased, are thus rendered incapable of performing their proper functions, or perform them imperfectly."—*Extract from the Gulstonian Lectures, delivered by J. Matthews Duncan, M.D., F.R.C.P., L.*

GRAZING RIGHTS IN FORESTS.

IN the letters which have recently appeared in the *Forester*, the effect of grazing on the forest vegetation has alone been discussed; and it has apparently been assumed that, provided it was shown that grazing was not immediately and directly injurious to the reproduction, no further objection could be made against it.

While, however, fully admitting that this is the most important point that we have to consider in connection with grazing, I am of opinion that the probable effects of grazing *rights* on general forest management deserve attention in a discussion on the policy of excluding grazing from a certain class of forests.

Apart from cultural considerations, I think that the existence of such rights would weaken our control over the forests, and that they would be, in general, an element of insecurity in our protective measures. All forest rights tend to become more onerous, and it is difficult, even where carefully prepared records exist, to prevent the demand the right supplies from gradually increasing during a long series of years with the general growth of the population. Moreover forest grazing has this peculiarity about it that, within limits of course, the more a forest is grazed over, the more pasturage will be found on it. The patches of short cropped grass increase in extent, and, as the cover lightens (as lighten it must in time in any forest where the grazing is constant and severe, but I will allude to this later on) spread over the entire area.

The history of forestry in all European countries furnishes us with numerous examples of the growth of rights, which, when granted, must have appeared harmless enough. In the *Forester* for April last, we find, as an instance of this, some interesting facts regarding the extinction of rights in Epping Forest:—

"The extinction of rights of fuel in the Manor of Waltham, Holy "Cross and Sewardstone, which were utterly destructive to the ap"pearance of the forest cost £15,000, and £7,000 were paid to the "inhabitants of Longton to extinguish their rights of lopping. The "entire cost of the arbitration cost £109,505."

In European countries, where the indirect evils from grazing are less injurious than in India, it has been admitted without question, not alone by professional foresters, but by the general public, that grazing rights are a serious danger to the State forests, and large sums of the public money have been devoted to the extinction of these rights. A recent writer in the *Revue des Eaux et Forêts* thus expresses this opinion:—

"L'Extinction des droits de pâturage dont les forêts dominales "sont encore grevées est de la plus grande importance, non seule"ment au point de vue de l'intérêt du Trésor, mais surtout au point "de vue de l'intérêt social. Personne ne conteste en effet, que "les droits de pâturage, quand ils ne sont pas une cause de détéri"oration progressive, de ruine finale pour les forêts, sont du moins "toujours un obstacle à leur amélioration."

In the peculiar conditions under which forest work is carried on in India, these objections to grazing, *in any forest whatever*, irrespective of the direct injury done to the vegetation, appear to me so weighty and important, that I think it would be impolitic to allow grazing rights of any sort, even in deodar forests, *whenever this can be avoided.*

But at the same time I agree with Mr. Moir in protesting against forests being left unreserved, simply because we cannot entirely exclude grazing from them, while I believe that grazing alone, when sufficiently severe and constant, can, *in time, cause the annihilation of* ANY *forest*, EVEN *deodar*. I am convinced that with proper restrictions, and by closing, if necessary, parts of the forest for a time, *any* forest can be at least preserved, in spite of grazing; but that a right of grazing from its tendency to increase, is always a serious danger, and should be avoided where possible. The fact that forests can exist and reproduce themselves in spite of moderate grazing, is proved by our finding forests still in India, just as conclusively as the fact that large forest areas have disappeared under the united influence of over-felling and grazing, proves the necessity for State interference in forest management.

But until the time, certainly not yet within a measurable distance, when the natives of this country more generally grow fodder crops, immense areas must continue to be devoted to grazing. Many of these areas, which as a rule are unfit for cultivation, are still fairly well stocked with timber, and could be improved and continue to furnish both timber and pasture under a simple system of forest management; and there are many cases in which, owing to peculiar circumstances, such as the feeling of the people, or the opposition of the Civil authorities, it is PRACTICALLY necessary to accept forests burdened with grazing rights.

But this is no reason why we should allow forests to be burdened with rights, when this can be avoided, under the mistaken notion

that they will not be an obstacle to improvement. *Apropos* of the discussion on the effect of grazing in deodar forests, some facts relating to the "chir" (*pinus longifolia*) forests in the Murree Hills may be of interest.

In many parts of these forests, where fires have not recently occurred, we find, in spite of grazing which has never been prohibited or in any way restricted, a dense crop of vigorous young seedlings, and these do not appear to have suffered in any way. Where, however, the cover of the forest has been removed by felling or lopping, so as to allow an unbroken stretch of grass to spring up, there are as a rule no seedlings. In several places the forest land has been cleared for cultivation and then abandoned. In sequestered places far away from villages, the forest has sprung up again on these cleared places, but where grazing has been more severe, this has not happened, and the cleared places remain perfectly bare. Now, as I have already stated, seedlings of any size do not appear to be injured by grazing, but it would appear that when they come up in short grass they are constantly browsed down while still very young. For it is impossible to suppose that none germinated in the bare places, when we find similar cleared places well stocked with seedlings. Darwin gives an example of this in his *Origin of Species*.

" But how important an element enclosure is I plainly saw near " Farnham in Surrey. Here there are extensive heaths with a " few clumps of old Scotch firs on the distant hilltops! Within " the last ten years large spaces have been enclosed, and self-sown " firs are now springing up in multitudes so close together that " all cannot live. When I ascertained that these young trees had " not been sown or planted, I was so much surprised at their " numbers, that I went to several points of view whence I could " examine hundreds of acres of the unenclosed heath, and literal- " ly I could not see a single Scotch fir, except the old planted " clumps. But on looking closely between the stems of the heath " I found a multitude of seedlings and little trees which had been " perpetually browsed down by cattle. In one square yard, at a " point some hundred yards distant from one of the old clumps, " I counted thirty-two little trees; and one of them with twenty- " six rings of growth, had during many years tried to raise its head above the the sterns of the heath, and had failed. No wonder that as soon as the land was enclosed, it became thickly " clothed with vigorously growing young firs."

I cannot believe that this does not take place in deodar forests also, and it would appear to be a mistake to suppose that animals grazing do not injure the young seedlings of species such as deodar and other conifers that, when older, they will not touch. In fact it would appear certain that where the grazing is sufficiently severe and constant, every seedling is eaten down as soon as it appears, and reproduction becomes absolutely impossible.

Of course, where the number of animals pastured is small compared with the area, this could not happen; and if in addition to this the land is hilly and uneven or rocky, the majority of the seedlings of unpalatable species, many of which would come up out of the little tracks followed by the animals when grazing or between rocks, would entirely escape injury from such limited grazing. We m..y indeed go further and suppose that where there was a struggle between a number of species, those that were unpalatable to the animals would be benefited by grazing under the conditions I have described.

It is, I think, this immense difference between *under*-grazing and *over*-grazing, between the injury done by a few animals *picking* and *choosing* their food among the undergrowth and patches of grass under the more or less complete cover of a forest, and the injury done by a crowd of animals constantly grazing on a continuous stretch of grass and probably, *involuntarily, cropping down every seedling, not absolutely poisonous or nauseous*, that accounts for the fact that while we have examples of hill forests disappearing in a few years almost entirely through grazing, we also find cases like those cited by Mr. Moir, or some of the pine forests I have mentioned near Murree, in which, in *spite of grazing*, reproduction goes on as vigorously as could be desired. The importance of this difference between the effect of light grazing and severe grazing is evident. As the wants the forests satisfy increase with the natural growth of the population, a harmless grazing right may, in the course of time, overwhelm the forest burdened with it.

That the supply of pasture in a forest tends to increase with the demand, I think will be evident to any one who examines a forest constantly grazed over, and who observes the change from soil and undergrowth of the least frequented or denser portions to the hard bare soil patches of short grass and, eventually, in the most frequented portions to the continuous stretches of short grass with occasional isolated trees.

With regard to Mr. Moir's very practical argument in favor of limited grazing in deodar forests, namely, that those forests in which grazing is *not* prohibited are in a very much better condition, as regards reproduction, than those protected from grazing, there is nothing contrary to reason or experience in supposing that the deodar seedlings are benefited where the cattle eat the grass and leave them untouched. But from what I have quoted, it would appear that if the grazing had been a little more severe and constant, this would not have happened, and the seedlings would have disappeared with the grass while still very young, and as grazing tends to increase, it is a wise policy to exclude grazing even where at first *not injurious*. But I am of the opinion of " Sw." (*vide* the *Forester* for March) that there is room to doubt that grazing alone was the cause of that superiority noticed by Mr. Moir in the forests grazed over as compared with those on which grazing had been prohibited. Very probably Mr. Moir is correct in his deduction, but he has not cited sufficient facts to place it beyond doubt, that grazing alone and nothing else caused the superiority.

Not long ago I heard a similar fact made use of to prove that *fires* were beneficial to pine forests,* and that consequently our teaching was nonsense. Since the last ten or twelve years the villagers have been prohibited from setting fire to the pine forests in the hills about Murree, which previous to that time they had regularly burned for pasturage every year. Many of these forests are now, indisputably, in a worse condition than they were some years ago. In fact in some places there are no seedlings at all, and as notwithstanding this the mature trees are being felled, these forests offer a perfect example of the conversion of pine forests into pure grass lands. But this deterioration is not due to the teaching of forestry as regards the injurious effect of fires being erroneous, but to the fact that fires have *occasionally* broken out, and having the accumulations of several years to feed them, instead of only one, or part of one, as they had formerly, have been much more violent and done much more damage than they did in former years, the seedlings being utterly destroyed instead of only scorched. It may be said that it does not much matter whether the theory or the practice was wrong, the result of forest work in this case is to render the last state of these forests worse than the first. But the failure is due to the common sense rules which experience has taught to be necessary in fire protective measures not being complied with. In fact the forests were made over to the Forest Department saddled with the impossible condition, as far as their protection and improvement are concerned, that the villagers could, with the consent of the civil authorities, extend their cultivation where they liked in them, and fell trees where they liked,† so that it has been impossible either to demarcate or fire-trace these forests.

It may not be out of place to recall here that not very many years ago it was argued that fires were beneficial to teak forests and assisted reproduction, and that by keeping out fires we were adopting a " wrong system."

The late Captain Forsyth, in " The Highlands of Central India," writes as follows:—

"The grass burning universal in these forests " (teak forests of of the Satpura Range) " is undoubtedly beneficial in a great variety " of ways." * * * * * *

" It has been held by some that these fires are very injurious to " the growth of teak saplings and other valuable trees, but it is " an undoubted fact that teak seeds will germinate and produce " better seedlings where the grass has been fired than where it has " not; and it is not well established that much permanent injury " is afterwards done to the seedlings. By great efforts fires were " kept out of one or two favourably situated teak forests for some " years, but no result of consequence to the young trees was ob- " served."

* * * * * * * *

" The discussion, however, can never assume much practical val- " ue, since it would be quite impossible, with any means at our " command, to keep fires out of any but a few very limited and " favourably situated localities."

Since this was written hundreds of thousands of acres of teak forests have been annually protected in the Melghat with indisputably a good effect to the forests, and the villagers themselves, the wild Gonds and Kukurs, recognise the wisdom of fire protection.

W. E. D'ARCY.

—*The Indian Forester.*]

* But the peculiar conditions under which these forests were made over to the Forest Department, the Forest Officer in charge cannot prevent this destruction, as the villagers can, under orders from the tehsildar, fell any trees they require for their own use.

† These forests are now being demarcated; as soon as this is accomplished, it will be possible to protect them properly.

EUCALYPTUS TREE IN THE ARGENTINE REPUBLIC.

CONSUL BAKER, of Buenos Ayres, says that the *Eucalyptus*, styled by some the " fever-destroying tree," is considered to be a very healthful tree, and the pungency of its leaves is such that it is never molested by insects; it is reported to be the only tree grown in the Argentine Republic which the locusts will not attack. It has the reputation of being an effectual destroyer or absorbent of malaria. In Australia, it is said, there are no marsh fevers where large forests of the *Eucalyptus* exist, and the trees have been planted in the Pontine marshes near the city of Rome, with excellent effect. In Buenos Ayres they bruise the leaves, and bind them to the forehead for nervous headache. The leaves themselves are a special abhorrence of such insects as prey upon fruits and fruit trees, against whose visitations they furnish protection by being scattered thickly on the ground underneath. Consul Baker is strongly in favour of introducing this tree into the majority of the European countries, and into the United States, and calls attention to the success which has attended its cultivation in certain districts of France, Italy, Spain, and Portugal. The tree has been planted on a large scale and with good results in Algiers, and at the Universal Exposition of 1867, in Paris, the trunk of a tree only eight years old, having a circumference of between five and six feet, was exhibited. The *Eucalyptus globulus* grows with a rapidity which is surprising. The first year of its planting, its usual growth is about 18 inches per month, when it is planted under favourable circumstances. Its increase in height is somewhat retarded during the second year, but the diameter of the trunk increases, and its branches begin to spread. Owing to this rapidity of growth, forests of these trees are obtained in ten years, which with other trees it would take a century to form. As an example of their increase, it may be stated that in Hyeres, seeds

planted in 1857 had, in 1865, reached the height of 58 feet. In Toulon, the plants grew to 24 feet in two years. In 1863, there were trees in Algiers of three years' growth, which had attained a height of from 30 to 35 feet, and generally in that country they grow at the rate of about 10 feet each season. In Australia, its native soil, trees of fifty years' growth attain an altitude of from 225 to 280 feet, and a circumference of from 50 to 60 feet, producing colossal boards or slabs 160 feet long and 12 feet wide. In the Argentine Republic, the tree has a perfectly straight trunk, and in the forests the branches rarely begin below 60 or 70 feet. The outside bark is loose and shaggy, like the plane tree. When young, the trunk is full of small branches, filled with bluish green leaves. In the first years of its growth the leaves are opposite and sessile, but as the tree assumes its true character they become petiolate and alternate, and their colour changes to a much darker hue, hanging vertically, and presenting their edges to the sun. Their two surfaces are exactly alike; the flowers are white, and produce a capsule-seed vessel of the size of a filbert, which is full of small black seeds similar to those of the onion. The tree will not grow from cuttings: it must be produced from the seed. These are generally planted in boxes, and afterwards transferred to small beds. Two or three seeds are generally planted together, and lightly covered with fine earth or river sand, and afterwards finely-cut straw is strewn over the top, as much to protect them from the hot sun as from heavy rains. In very dry seasons the small plants are watered every fifteen days, but this is not absolutely necessary. The tree requires a deep soil and permeable, neither too light nor too compact, and it does not grow to advantage when there is too much humidity in the earth. The usual time for planting the seed is in the months of February and March. The seeds begin to sprout in eight or ten days. The cultivation of the *Eucalyptus* in the Argentine Republic has only two difficulties to encounter, the first being the irregularity of the seasons. A hard frost out of season, which sometimes occurs, may destroy a large number of plants. It is, however, very rarely that trees that have safely passed the first winter will afterwards be killed by frost. Although the tender shoots may suffer, the tree, for that reason, does not die, but with the first favourable weather new and stronger shoots will spring up. After having changed their leaves, the trees appear to be able to endure greater cold. The other difficulty with which they have to contend is the wind. On account of their rapid growth, the trees become top-heavy with their weight of leaves; and the roots for sustaining such an enormous pressure as a high wind produces are relatively small, so that a south-west *pompero*, especially after a rain-storm, will sometimes uproot whole plantations, and this is particularly likely to happen during the second year of their growth. To provide against this, planters in Buenos Ayres make use of stakes and supports to guard against the danger to which the trees are exposed. When the trees are placed close together, they assist to protect each other, and when they are planted under the lee of a belt of timber, which is frequently done, they are better enabled to resist the wind. After the third year they are thinned, and those thus cut away are used as stakes or guards for the rest.—*Journal of the Society of Arts.*

CINCHONA.

THE following is the resolution on the Annual Report of the Government Cinchona Plantation in Bengal for the year 1882-83, and the Annual Report of the Quinologist for the same year:—

The result of the planting operations of the year shows a decrease of about 50,000 cinchona trees on the returns of 1881-82. This is due to the uprooting of a large number of the *Calisaya* and hybrid varieties which were found to possess bark of poor quality. Some 160,000 red bark trees were also uprooted in the ordinary rotation, and were replaced by the yellow bark and hybrid varieties. Nearly all the land within the existing cinchona reserve suitable for the cultivation has now been planted out, and the Superintendent accordingly applied, in October last, for permission to plant out with *Ledgeriana* and the hybrid variety a tract of land in the trans-Teesta portion of Darjeeling which had been reserved for Government cinchona cultivation. Both these species have been proved by repeated analyses to be very rich in quinine, while most of the yellow bark or quinine-yielding trees on the existing plantations at Mungpoo are quite young, and the whole stock is not sufficient to furnish, even when mature, enough bark to employ the factory profitably for more than a few weeks in the year. There is in fact no plantation of these trees actually in existence, while the nurseries have a magnificent stock of nearly half-a-million plants of the best sorts of yellow bark trees which would be lost unless the seedlings were speedily planted out. The proposal for forming the new plantation was readily approved by Government, and measures have since been taken for planting out the reserve with a number of the best kinds of *Ledgeriana* and hybrid cinchona.

2. In the Resolution recorded upon the proceedings of last year, it was remarked that there were several distinct forms of the hybrid variety, and analyses were given of the samples of bark of four of these forms. During the year under review the Superintendent had analyses made of four more of these forms, and the results obtained from all the eight hybrids are compared in the following tables:—

	No. 1.	No. 2.	No. 3.	No. 4.
Crystallised sulphate of quinine	2·87	1·48	1·88	0·97
Crystallised sulphate of cinchonidine	2·94	2·85	2·93	1·94
Crystallised sulphate of quinidine	traces.	traces.	traces.	traces.
Cinchonine (alkaloid) ...	0·72	0·57	0·52	0·80

	No. 5.	No. 6.	No. 7.	No. 8.
Crystallised sulphate of quinine	2·12	2·04	6·12	3·90
Crystallised sulphate of cinchonidine	2·84	2·26	2·46	3·33
Crystallised sulphate of quinidine	traces.	traces.	traces.	traces.
Cinchonine (alkaloid) ...	0·33	0·68	0·55	0·57

Dr. King points out that hybrid No. 4 is very poor in quinine, and it was the trees of this sort that were uprooted during the year. No. 7 appears to be exceptionally rich in quinine, and the plantations of this variety might with advantage be extended.

The total number of cinchona trees of all sorts at the close of the year was 4,711,178, namely red (*Cinchona Succirubra*) 3,713,200, yellow (*Calisaya Ledgeriana*) 662,998, hybrid unnamed variety 304,378, and other kinds 30,592.

3. It is satisfactory to observe that the crop of the year is the largest that has yet been harvested on the plantations. It amounted to 396,980 pounds of dry bark, of which 372,610 pounds were of *Succirubra*, 22,120 pounds of *Calisaya* and *Ledgeriana*, and 2,250 pounds of hybrid bark. By far the largest portion of the produce was made over to the factory for conversion into cinchona febrifuge, while about 41,800 pounds of yellow and red barks were sent at the request of the Secretary of State to London to be there converted into various forms of febrifuge, and returned to this country for trial by the Medical Department.

4. The expenditure on the plantations amounted to Rs. 80,739-6-2 against the budget allotment of Rs. 82,225. Of this expenditure Rs. 17,548-3-2 was incurred on the newly opened trans-Teesta plantation, and on the young plantation at Sittong. This sum is chargeable to capital account. The balance, amounting to Rs. 63,191-2-5, which was spent on the old plantation, and includes charges on account of packing and carriage of bark sent to England, is chargeable as working expenses.

5. It is disappointing to notice the continued failure of *Carthagina* bark, notwithstanding that the utmost care has been taken of the plants and every endeavour made to grow them at various elevations and with various exposures. Only three plants were alive at the close of the year. An attempt has been made by the Superintendent to introduce the *Remija* plant, which is a genus botanically allied to cinchona. It is said to be less particular than cinchona as to soil and climate, and produces a quinine-yielding bark under the name of *Cuprea*. This bark forms a very large proportion of the quantity of quinine bark imported into Europe. Although the first attempt to grow the plant in the Mungpoo plantations has not been quite successful, Dr. King entertains hopes of successfully acclimatizing it, when he is able to procure a more adequate supply of seed. The Lieutenant-Governor will await the result of the experiment with much interest. The surplus seed of the *Calisaya Ledgeriana* was as usual distributed during the year gratuitously amongst applicants.

6. Dr. King has eventually succeeded in obtaining an analysis of the bark renewed on *Succirubra* trees that had their original bark removed by the shaving process introduced by Mr. Moens, the distinguished Director of Cinchona Cultivation to the Dutch Government. It appears that this process consists in shaving off the greater part of the bark of a living tree to the height of from eight to ten feet from the ground, care being taken to leave everywhere a sufficiently thick layer of bark to cover the wood. This method has had a fair trial on the Sikkim plantations, and the result has, beyond doubt, been favourable, as the bark renews perfectly. What, however, remained to be seen was whether the renewed bark was as rich in medicinal alkaloids as the original. It was with the object of determining this question that the analysis above referred to was undertaken during the year. The results are thus described by Dr. King: "The bark renewed rather slowly, but the analysis shows that it is very rich both in quinine and cinchonidine; and there can be no doubt that in countries where red bark trees are perfectly at home, and where their continuance in good health and vigour for a long series of years can be absolutely counted on, this shaving process must be a very excellent one."

7. An interesting feature in the operations of the year is the low cost at which the febrifuge was turned out. The price of the febrifuge necessarily fluctuates from year to year, but in no former year has it been so low as Rs. 8·8 a pound. This satisfactory result is attributed chiefly to the larger percentage of the alkaloids (2·73) extracted from the bark used in manufacture. The issues, however, fell below those of 1881-2, though they were a

little in advance of those for 1880-81. The following table compares the distribution in the past three years :—

	1880-81. lb.	oz.	1881-82. lb.	oz.	1882-83 lb.	oz.
To Medical Depot, Calcutta ...	3,000	0	3,386	0	2,000	0
Ditto, Bombay ...	2,000	0	1,000	0	1,000	0
Ditto, Madras ...	500	0	800	0	350	0
To Colonial Government, Mauritius	......		......		150	0
To Surgeon-General for District Medical Officers of Bengal ...	......		995	4	803	12
To Inspector-General of Jails for jails and lock-ups, Bengal ...	......		14	12	26	12
Sold to the public	3,150	11	4,680	0	4,560	12
Given as samples	3	2	2	9	10	0
Total ...	8,653	13	10,878	9	8,901	4

The issues to the public were 120 pounds below those of 1881-82, and not in excess of that year as stated in the superintendent's report. The stock of febrifuge in hand on 31st March 1883 amounted to 2,962¼ pounds, which, though greater than that with which the year opened, is by no means too large a reserve to meet emergencies.

The revenue derived from the sale of the febrifuge, seed, plants, and bark amounted to Rs. 1,52,807-1-0—

	Rs.	A.	P.
By sale of febrifuge, seed, plants, and bark to the public	80,577	9	0
By credits from the Medical Depot of Calcutta	33,766	0	0
Ditto ditto ditto of Bombay	16,500	0	0
Ditto ditto ditto of Madras	5,775	0	0
Ditto from Colonial Government of Mauritius	2,475	0	0
Ditto from the Surgeon-General, Bengal ...	13,271	8	0
Ditto from the Inspector-General, Jails ...	442	0	0
Total ...	1,52,807	1	0

The operations of the year resulted in a profit of Rs. 66,284-9-5, which is equal to a dividend of 6¼ per cent on the capital outlay. This is exclusive of the cost of a considerable quantity of the bark sent to the Secretary of State which has not been taken into account. It must, moreover, be borne in mind that these profits do not represent the whole of the gain of the year. The cost of an equal quantity of quinine at Rs. 96 per pound would have been Rs. 4,01,328. The cost of the febrifuge used was Rs. 68,088-8. There was thus a saving of Rs. 3,32,340. The total saving effected since the opening of the factory by the substitution of the febrifuge for sulphate of quinine amounts to Rs. 23½ lakhs, which is more than twice the amount of the cost of the plantations.

9. Considerable attention was given during the year to the improvement of the process of manufacture. The present system is admittedly wasteful, in that it fails to convert into febrifuge the whole of the alkaloids which the bark contains, while there is no doubt that, by the adoption of a different and more costly process of manufacture, a still larger percentage of the medicinal alkaloids could be extracted. It is not, however, equally certain whether the febrifuge so obtained could be turned out at a less cost per pound. The whole subject of the course to be adopted in the disposal of the raw produce of the plantations is still under the consideration of Government.

10. The thanks of the Lieutenant-Governor are again due to Dr. King, whose management of his department leaves nothing to be desired. Dr. King has reported very favourably of the services of Mr. Gammie, and the Lieutenant-Governor entirely concurs in the praise accorded to him. The other assistants of the department are also well spoken of.

MR. MOENS'S WORK ON CINCHONA.

IN the *Indische Mercuur* for 21st June is a review, by Mr. K. W. Van Gorkom, former Director of the cinchona culture in Java, of *De Kinacultuur in Azie, 1854 tot en met 1882*, by J. C. B. Moens, Director of the Government cinchona enterprise in Java. We translate the notice as follows :—"With this work, the fruit of years of long study, experiment and observations, the writer has crowned his lengthy rule of the Government cinchona culture in Java. The book, a quarto, printed, with wide margins on thick paper, with full list of contents and alphabetical index, occupying not less than 393 pages, comprises a careful description of the history, culture, harvesting, and botanical as well as chemical peculiarities. The magnificently executed phototypes, taken from nature by Mr. C. Lang, give, by their clear and accurate representations, a still higher value to the entire work. This work, as a whole, both in its contents and in its costly execution, is above our most unqualified praise, and we do not hesitate to recommend it as an excellent standard work, which, in the field of quinology, surpasses all works which have hitherto appeared, both in fullness and accuracy. And no one was better in a position to furnish us with such a ripe fruit. Engaged since 1872 as chemist to the cinchona culture in Java, and from April 1875 to April 1883 superintending it in its entirety, Mr. Moens had the most favorable opportunity to study both the historical and the practical scientific problems in all their bearings and to place them in a clearer light. A month's visit to the cinchona plantations in British India, extensive and intimate relations with the best quinologists in Europe, would preserve from prejudice, and the remarkable book, a interesting and indispensible in the highest degree to the planter and the merchant as well as to the merely scientific student, bears on every page the evident traces of wide and at the same time profound views. Science owes special thanks to the Medical Union of Batavia, who undertook the publication of such a costly work. No library of importance should be without the book. May it be the privilege of the honored and respected writer to continue to utilize his extensive quinological knowledge still in his native country for the highest interests of culture and of commerce !"

FORESTRY.

TAPPING *PINUS LONGIFOLIA* FOR RESIN.

AS there is some likelihood of a considerable demand arising almost immediately for *Pinus longifolia* resin, the subject of tapping that tree ought to possess no slight interest for the Himalayan forester.

The extensive forests of this pine which stretch along the lower slopes of the outer North-West and Punjab Himalayas have hitherto remained valueless except at a few points, such as Naini Tal, Ranikhet, &c., where the wants of a large local population and the absence or insufficiency of other woods have raised this pine to the position of the chief or sole timber and fuel tree. Not that there is no market for its timber in the numerous wealthy towns situated within a hundred miles of the hills, but present prices are as yet too low, and transport too difficult and costly to make export from these hills pay. Hence every circumstance likely to increase the value of the pine ought to be very welcome. Should the tapping of the tree for resin prove remunerative, the result may be that we shall be able to work several hundred square miles of well-stocked, hitherto unproductive forests, for the conservation of which other forests have at present to pay, and which hence make our financial position appear year after year much worse than it really is, and act as a drag on the progress of the Department.

There is on the surface no reason why the *Pinus longifolia* should not be as important a source of wealth to Northern India as the cluster pine is already to the West of France, even with its present very imperfect means of communication. As in both trees the largest quantity of resin is contained in the sapwood, it is probable that the method employed in tapping the one will suit with little or no modification the other. Readers of the *Indian Forester* will hence perhaps find the following extract from the translation of Bagneris' *Elements of Sylviculture* interesting. It describes the method employed in tapping the cluster pine, and gives some information regarding the amount of yield and price of the resin and its manufacture into the various products used in the arts. The excellent illustrations which accompany are from the pen of Mr. A. F. Broun, who has kindly drawn them at my request for the *Indian Forester* :—

"There are two methods of resin-tapping, which in French are termed respectively *gemmage à mort* and *gemmage à vie*. The first exhausts and kills the tree (whence the name), and is adopted only when the tree is to be felled soon after; the second, as may be guessed, has for its object to obtain the resin without causing the death of the tree. In either case, the first thing to be done is to take off gradually a rectangular strip of bark, beginning at the foot of the tree and going up about 4 inches; a little wood must also be removed with the bark. The wound thus made is technically called a *quarre* or blaze. The instrument used is a light axe with a curved head and a handle bent at an angle in the direction of the concave face of the head. Once or twice a week the wound is re-opened, and it is at the same time lengthened by taking off a fresh strip of bark and wood above it about two-fifths of an inch long. In this manner the wound attains a certain length, which in the forests under the control of the Forest Department ought never to exceed 11 feet. Moreover, in the printed stipulations which contractors bind themselves to observe when they purchase the right of resin-tapping, there is a clause which fixes a maximum of 5 inches for the breadth of the *quarre*, and a maximum of two-fifths of an inch for its depth.

"Only one *quarre* at a time ought to be worked in those trees which are not to be felled in the next thinning operations. To prolong their existence, it would even be desirable to make the *quarre* only 3 inches wide. The same *quarre* is worked for 5 years by the process explained above of freshening and lengthening the wound. During the first year it is lengthened by 22 inches; during each of the three succeeding years by 26 inches; and during the fifth year by 28 inches. At the end of this term a new *quarre* is opened which is worked in the same manner. This process is repeated until within a few years of the felling of the trees so tapped, when the process called *gemmage à mort* is employed.

"No tree is tapped in the manner we have just described before it has attained a circumference of 3 feet. M. Lamarque is of opinion that it would be better at the beginning to work a *quarre* for only four years, and then give the tree rest for one year. The *quarres*, when left alone, soon heal up by the formation of new rings of wood and bark, and some time after a new *quarre* may be opened in the swelling formed by the bark immediately over the old *quarre*.

"The swelling is a sure indication of the existence of an old *quarre* beneath, and some old trees may be seen here and there bearing traces of several of them. It frequently happens that from want of sufficient adherence, the bark separates on each side of the old wounds, the separation being wider at the middle, where also the consequent swelling out of the bark is naturally greater. This phenomenon gives the lower part of the stem the shape of a spindle, and the trunk looks as if it was being crushed under the weight of the portion of the tree above.

"In private forests the *quarres* are often allowed to reach a height of 13 to 16 feet, and two or three are worked at a time on thick trees. This is a bad practice. If for the time being a tree

is made to yield a large quantity of resin, its longevity is materially shortened.

"As we have already indicated, *gemmage à mort* is practised only in the case of trees near their maturity, or of those which are to be felled in the very next thinning operations. It is begun as soon as the trees are big enough to contain a *quarre*, in other words, as soon as the they have attained a girth of 20 to 24 inches. This generally happens at the age of 20 years. The *quarres* are opened in precisely the same manner as in the first process, only they are worked up faster, and several at a time are opened in each tree. Usually a tree treated thus dies in three or four years.

"When a new *quarre* is cut or an old one re-opened, the resin oozes out in bead-like drops. A portion of it flows down the wound: the rest, owing to volatilisation, solidifies and forms a crust over the exposed wood. This solid substance is known under the name of galipot. Formerly the resin was allowed to run down to the foot of the trees, where it was received in a little trough hollowed out in one of the roots or in the sand. Much of the resin was thus lost by absorption in the sand, especially in the first year. Little earthenware pots are now used, which are hung along the stem of the trees and are raised as the *quarre* is worked up higher. To get the resin to flow into the pots, a small curved plate of zinc is lightly driven in an oblique direction into the wood immediately over each pot.* The pot is kept in its place by means of a nail fixed under, and on which it rests lightly. To render the waste still smaller, the pot is covered with a thin board, which prevents the loss of the volatile portion of the resin. The resin-tapper examines the pots when he goes round to re-open the wounds, and empties any he finds full. The gallipot is scraped off once or twice a year.

"The use of these pots and plates of zinc constitutes the method of Mr. Hughes. It requires a heavy outlay at first, but it possesses the advantage of yielding a larger quantity of resin, and that in a purer state. According to Mr. Samanos the results of this method, as compared with former results, are as four to three. It is much employed in the Dunes at Cape Breton, Mimizan, Biscarosse, and la Teste. But in the district round Dax its use is not so general, while at Mont de Marsan it is still rare. This is a source of much loss. To diminish the waste of resin by absorption in the soil, the tapper makes the same trough serve for several successive *quarres*. They are consequently obliged to cut little canals all round the foot of the tree leading one and all into the same trough. Those canals are necessarily cut right into the wood, and thus soon kill the tree.

"Resin-tapping is carried on only in the interval between the 1st March and the 15th October: but the gradual thinning off of the bark is begun as early as the 10th February.

"Resin is most abundant in trees which measure at least 16 inches in diameter. A pine of this size yields annually three litres by the process of *gemmage à vie*. Taking into consideration the continual diminution in number of the trees, we may reckon that an acre yields annually about 30 gallons, whatever be the age of the forest. It is not so easy to calculate the yield by the process of *gemmage à mort*. Still it is generally admitted that from 80 to a 100 pines, 8 inches in diameter, will also yield annually the same quantity, and that for three years. On the estate of M. Marcellus, near Biscarosse, I saw a pine 13 feet in girth and 30 feet high up to the first branch, which had ten *quarres* worked on it simultaneously, and which still yields seven or eight litres of resin annually.

"The price of the raw resin is necessarily very variable. Sometimes it is as low as 40 francs a *barrique* (340 litres). During the American War, it rose to 290 francs. At Mont de Martan where it is converted into the different manufactured resin products of commerce, the actual price of a *barrique* is 120 francs.

"The resin-tapper is paid so much per *barrique*, usually from 30 to 45 francs; which gives an average of four or five francs a day.

"I visited at Mont de Marsan several distilleries. In one of them they distil the resin for spirits of turpentine. The raw resin always contains, according to the care with which it has been collected, a greater or less quantity of impurities, such as lumps of earth, chips of wood and bark, leaves, &c. To remove these the resin is put into boilers in which it is subjected to a temperature just high enough to liquefy it without causing it to volatilise. In this liquid state it is passed through sieves of rye-straw into troughs. The clear liquid is known under the name of *terebenthine*.

"From the troughs the *terebenthine* is conducted through a pipe supplied with a stopcock into a still. During the distillation, a thin continuous stream of water is introduced into the retort by means of a funnel. The water, in the state of steam, carries over with it the spirits of turpentine, and after condensation in the worm they are both received into a vat.

"They are then separated by the process of decantation. Colophony and black and white resin are made from what remains in the retort. A conduit-pipe leads this residue into a trough, whence it is passed through a very fine brass sieve into a wooden chest; what is collected in the chest is colophony: what is left behind in the sieve is black resin. It is made into cakes of from 100 to 200 lbs., by pouring it while liquid into troughs hollowed out in fine sand. White resin is prepared in the same way, except that the hot residue in the sieve is agitated briskly in one-tenth its volume of water before it is poured out into the sand moulds.

"All these products have their special industrial uses. Spirits of turpentine are employed in medicine, in the preparation of varnishes and plants, for lighting, for cleaning furniture, &c. The solid products enter into the manufacture of paper, soap, stearine candles, torches, sealing-wax, &c., and are also used for the caulking of vessels.

* A much simpler and more effective plan is now followed. A flat plate of zinc with one corner slightly curved upwards, is driven obliquely across the quarre, the curved corner being immediately over the pot which is hung on one side of the quarre.

"The residue from the first filtration of the crude resin is burnt in special stoves, and yields tar and pitch.

"One *barrique* of crude resin gives 100 kilos of spirits of turpentine, which, taking actual prices, would be worth about 125 francs; the other products cover all expenses and yield besides a trifling profit. Black rosin sells at the rate of 18 francs per hundred kilogrammes; the price of the same weight of white rosin is 20 francs.

"In another establishment in the same town, the black rosin is heated to a high temperature, by which a double decomposition takes place. The result is, according to the manipulation employed, the separation of certain volatile oils used in varnishes, or of certain fixed oils which are used for lighting, for impregnating wood, in making wheel-grease, in the manufacture of printing-ink, &c."

In the Himalayas the *Pinus longifolia* is already tapped on a small scale, the crude resin being sold in the bazars under the name of *biroza, ganda phiroza, dhup, berja, lisa, khalja, &c.* A small quantity of turpentine is also distilled therefrom for sale in the neighbouring towns. This industry was carried on more extensively before the conservation of the Government forests, since which time the tapping of the pine therein has been strictly forbidden. This is a measure much to be regretted. No doubt the extremely primitive and fatal method of tapping is responsible for the crippling of that very useful industry, but nothing was easier than for the forest officers to teach the hill-men improved methods.

The present system employed in the hills of Kumaun and Garhwal is to cut a sort of niche in the stems of the trees from 3 to 4 feet from the ground. The bottom of the niche is hollowed out into a shallow trough to receive the resin as it oozes out. The trough is cleared out as often as it fills, sometimes as soon as the second or third day, but usually between the fourth and tenth day, when the niche is first made, and at longer intervals afterwards. Generally the resin-tapper does nothing more to the niche once it is made, but as the resin volatilises and hardens over the wound into a crust which impedes the flow of fresh resin, he sometimes chips off the wood on the sides so as to get rid of this crust. The same niche is used for two and even three consecutive years when no forest fire occurs, which either burns down the tree or chars the resin-encrusted wood of the niche to a depth of an inch or more.

Tapping begins in February and ends in May or June, *i.e.*, during the period of comparative vegetative repose. As soon as the buds expand and the tufts of new leaves are developed, the outflow of resin either ceases or becomes too insignificant to be collected. The higher the temperature and drier the weather is, the more copious is the exudation of resin.

As regards the yield per tree, the quantity is very variable according to the size and vigour of the tree, the state of the season, the nature and condition of the soil, and the number of niches cut. As the hill-men never concern themselves about the life of the trees they tap, they work several niches simultaneously, the result being either death by exhaustion or the breaking of the tree by the wind helped by forest fires—a veritable *gemmage à mort.** Mr. Richard Thompson (Brandis's "Forest Flora," page 507) says that "the yield of an ordinary sized tree is 10 to 20lbs. of *berja* for the first, and about a third of the quantity the second year," in other words, from 13 to 27lbs. My own information collected in Garhwal and Kumaun gives the yield of a single niche—4 to 6lbs. the first year, and rather less than a half of that the second year, or from about 6 to 8½lbs. in all. As a small tree would contain two and a large one three niches, these figures agree pretty nearly with Mr. Thompson's. The largest outflow takes place when the niches are just cut, as much as 1lb. being sometimes obtained from a single niche from an average sized tree.

If we adopt the system of the French Landes, with the slight modifications, if any, it will require, we shall probably obtain by the method of *gemmage à vie* about the same quantity annually that is now taken out of a single niche during the first year. In other words, there is every reason to expect that the yield per tree in our *Pinus longifolia* forests will be little, if at all, inferior to the yield per tree in the cluster pine forests of the Landes. And we have in our favour cheap labour: the Landes resin-tapper earns from Re. 1·14 to Rs. 2·6 per day; his Indian *pahari* brother will think himself lucky if he is paid 8 annas a day.

Last year at Naini Tal Mr. Braidwood very kindly supplied me with some crude *Pinus longifolia* resin, from which I distilled essential oil of turpentine, the residue being a pale straw-coloured colophony. The resin was full of impurities (about 5 per cent.) From 3½ gallons I obtained 3 quarts of oil, and about 20lbs. of colophony. I lost a good deal of the resin in clearing it through a sieve, and the worm of my still leaked very considerably. We shall probably not be far wrong if we assume that the yield of oil under favorable circumstances would be about 30 per cent of the crude resin, or about the same as in the case of the cluster pine.

Some of the essential oil I distilled was submitted by Mr. Greig, the Conservator, to Mr. Morrison, Pharmaceutical Chemist at Naini Tal, for professional opinion. I have not seen Mr. Morrison's written report, but he told me in conversation that he had subjected the oil to the prescribed tests, and had found it, as regards medicinal purposes, equal to the best imported oil, except that its odour was much less pungent. For industrial purposes it will probably be found to be quite as good.

* The vitality of *pinus longifolia* is, however, so extraordinary, that in forests from which the resin-tapper has now been excluded during the last 10 years and more, thousands of trees may be seen containing old charred niches. The bark may be stripped off over a breadth of 4 or 5 feet all round the trunk, without necessarily killing the tree.

A proposal has recently been made to use the crude resin for the manufacture of lighting gas, and if the necessary quantity is forthcoming, a trial is to be at once made. Whatever this idea may ultimately come to, some experiments ought certainly to be undertaken in tapping the pine, and manufacturing from the crude resin the various commercial products it can yield. What locality could be more favorable for the purpose than the hill-forests of the School Circle of the N.-W. Provinces? Success, which is assured if the experiments are properly carried out, will result in every *Pinus longifolia* tree, which is now practically valueless, yielding 8 annas yearly, and every moderately well-stocked acre Rs. 15 per annum!

E. E. Fernandez.

—*Indian Forester.*]

EAST INDIAN FURNITURE WOODS.

TOON WOOD (*Cedrela Toona*) is light, soft, and red, and has no heartwood. It is not eaten by white ants; it is highly valued, and universally used for furniture of all kinds, and is also employed for door panels and carving. From Burmah it is exported under the name of "Moulmein Cedar," and as such is known in the English market. It there fetches about Rs. 63 per ton, the cost of cutting and delivery being Rs. 44, according to Major Seaton. In North-West India, it is used for furniture, carvings, and other purposes. In Bengal and Assam, it is the chief wood for making tea-boxes, but is getting scarce on account of the heavy demand. The Bhutias use it for shingles and for wood carving; they also hollow it out for rice-pounders. It is, or rather used to be—for very large trees are now rather scarce—hollowed out for dug-out canoes in Bengal and Assam. In Bengal, Assam, and Burmah, it grows to a very large size, trees 20 feet girth, with a height of 80 to 100 feet of clear stem, being not uncommon in forests which have been only little worked, like those in Dumsong and in some parts of the Chittagong Hill Tracts.

Chickerassi or Chikrassi Wood (*Chikrassia tabularis*) is a large tree, with bark reddish brown and deeply cracked. The heart-wood hard, varying from yellowish brown to reddish brown, with a beautiful satin lustre; seasons and works well, and is used for furniture and carving.

Nagesar Wood (*Mesua ferrea*) has dark red heartwood, extremely hard. It has been found to answer for sleepers equally well with Pynkado, but the cost of cutting the hard wood, its weight, and the freight from the Tenasserim forests to Calcutta prevent its being much used, as the total cost is scarcely covered by the price (Rs. 5) per broad-guage sleeper. It is used for building, for bridges, gunstock, and tool handles: but its more general use is prevented by its great hardness, weight, and the difficulty of working it.

Pitraj Wood (*Amoora Rohituka?*) is reddish, hard, close and even-grained, but is little used. In Chittagong, canoes are sometimes made of it.

*Kandeb Wood (*Calophyllum polyanthum*) is light red, shining, cross-grained, and moderately hard. It is used largely in Chittagong for masts, spars and rafters, and sometimes for small boat-building and canoes.—*Gamble's Manual of Indian Timbers.*

Tal Wood (*Dichopsis polyantha*) is red and hard, and is much valued in Cachar and Chittagong. Mann says it does not float; but he must refer to green-wood. Major Lewin says it is used in Chittagong for making beds, tools, &c., and is sawn in boards for the Calcutta market.—*Timber Trades Journal.*

There are large tracts of virgin Nagesar forests in the Garo Hills and other parts of Assam, and if the Assam Government would imitate that of the N.-W. Provinces in spending money liberally on roads and timber slides, this large field for enterprise might be opened out. The Mechis are most patient and experienced wood-cutters, and nothing is wanting but proper means of export; and now that the demand for railway sleepers for the projected North-Eastern Frontier Railways is assured, it seems a pity that they should be dependent on Europe for their sleepers, whilst such vast natural resources are close at hand.

Some Toon logs have lately been sent from Dehra Doon to London, to Messrs. Church and Sims, and realised in a sale by public auction 4½*d*. per superficial foot.

Messrs. Churchill and Sims report that Toon resembles West India Cedar, but is too hard to be used for the ordinary purposes for which the latter wood is imported, namely, cigar boxes and cabinet work.

Regarding a previous consignment of Toon, however, the same firm reported that it would prove saleable as a substitute for Mahogany, if sent in well squared (*hewn*, not sawn) logs, about 15 inches square and 12 feet and upwards in length, and would command 2*s*. 6*d*. to 3*s*. per cubic foot. The price lately obtained, £18 16*s*. 6*d*., for 112¼ cubic feet, was nearly 3*s*. 8*d*. per cubic foot, but this is accounted for by the present scarcity of West India Cedar in the London market.

If Toon wood can be delivered in any large quantity at Chittagong or at any Burmese port, it might be profitable to send some trial shipments to London, though of course export from the forests of Northern India is out of the question, both on account of the scarcity of the timber and local demand for it, and also owing to the prohibitive charges for transport by rail to the seaports.—*Indian Forester.*

THE GARDEN.

THE CULTIVATION OF ORCHIDS.

THE cultivation of this highly interesting and beautiful class of plants is not an easy matter, even although India is the home of a great many of them. The largest class are epiphytes, and are found growing on trees, and sometimes on the face of rocks, in the doons and valleys along the base of the Himalayas, and in other hilly parts of the country. The terrestrial species are numerous in the high and more temperate regions, but as there are only one or two species cultivated in gardens on the plains, I do not intend to speak of them at present.

As they are found growing on trees in a natural state, it is also natural to suppose that they will thrive best under cultivation, if nature is imitated as closely as possible. When a garden contains suitable trees, they should always be made use of for orchid culture, but as this is not always the case, artificial methods have to be adopted. When selecting a tree for their culture, seek out one that is full grown; if it is old and beginning to decay, so much the better. Never select a young and vigorous growing tree, as its vigour and growth tends to throw off such encumbrances as orchids. If an orchid is securely tied upon a tree of this class, and regularly watered, it will live for a long time, although it seldom makes enough root growth to cling to it without artificial support. In orchid culture, diminished root growth means scarcity of flowers, therefore we must do all we can to encourage the production of healthy roots. The species of tree to select is also a matter for consideration. The mango is one of the commonest trees in our gardens, and luckily it is one of the best for orchid culture. The jamun, and other rough barked species, are also very good, but I have found that orchids do not establish themselves so quickly upon it, and other species I have tried, as upon the mango. The best season for collecting orchids from the jungle for garden culture is from November to January. They are quite at rest then, and will bear removal without any injury. When you have collected and deposited them safely within your garden, tie them up at once, or plant them in the baskets I have described below. Copper or brass wire is the best tying material, but if not obtainable, strong string may be used. If the roots are slightly covered with moss before running the wire over them, it will be found to be beneficial for retaining moisture, and keeping the wire from cutting them.

Hanging baskets, made from bamboos and blocks of wood, is the two commonest artificial methods of growing them. The first-named I consider to be the better method of the two, and when filled up with nice healthy plants, they always look very ornamental. They are easily made, a common village carpenter will turn out three or four of them in a day. When filling them up, the orchids should be planted in the middle, in a mixture composed of wood chips, pieces of charcoal and moss if obtainable. They thrive best if hung up under the shade of a large tree, but will succeed tolerably well if hung in a verandah. Blocks of wood may be very suitable for damp climates, but in the dry climate of the N.-W. Provinces orchids never look happy upon them. Bamboo baskets should, therefore, be always used in preference. When cultivated in baskets or on blocks of wood, orchids require a greater quantity of water than they ever get in their natural state. When clinging to living trees they probably inhale small quantities of moisture through the bark. The absence of this natural moisture in bamboo baskets, and cut blocks of wood, is probably the cause of a greater quantity of water being required. I may possibly be wrong in my supposition, as a high botanical authority defines the word "epiphyte" as a plant that grows on trees without deriving any nourishment from them. Whether right or wrong, experience proves that water cannot be withheld for months at a stretch under cultivation. Water should, therefore, be given once every day to orchids grown in baskets or on blocks, except during the months of November, December, and January. Three times a week is sufficient during those three months. Those grown on trees should also be watered once a day until they are well established. When they have once taken a firm hold of the tree, they will thrive with less water than required for baskets and blocks.—W. G.—*Indian Forester.*

CULTIVATION OF THE ARTICHOKE.

(*Cynara Scolymus L. Compositæ DC.*)

THIS vegetable is a hardy perennial, a native of Barbary and South of Europe. It appears to have been esteemed as a vegetable from very early times, as Pliny speaks of it as having been cultivated by the Romans. The culinary part is contained in the immature flower heads. The broad fleshy flower receptacle termed the bottom, and the thick base of the horny involucral scales, are the parts eaten. It succeeds with little care and trouble, and is often met with in the gardens of Europeans, but seldom in those of natives.

On the plains the flower heads begin to appear in March, but are most plentiful in April, and continue in season until the middle or end of May. The plants are raised from seed or by suckers. The former should be sown broadcast in beds, from the beginning of August to end of September. The seedlings are very hardy, and seldom suffer from damp; the seeds should, therefore, be sown as soon as an opportunity occurs after the beginning of August. When they have made four or five leaves they are fit for transplanting to where they are intended to be grown. They love a deep and rich soil, and when preparing the ground

for their reception it should be trenched 2 feet deep and liberally manured. When time and labour does not allow of such an effective preparation of the ground, holes 2 feet broad and 2 feet deep should be dug, and the soil thrown back liberally mixed with old manure. The plants should be transplanted at 2½ feet apart, in rows 4 feet asunder. They should be watered regularly, and the soil between the plants occasionally stirred with a fork. When raised by suckers the strongest should be separated from the old plants in September, and at once transplanted at the same distances apart as given for seedlings. They should be annually transplanted in a fresh plot of ground. If this is not done the flower heads decrease in size, and by the third season are all but worthless. It is a good plan to raise one-half of a plot from seeds and the other by suckers. The latter should be annually thrown away after the flower heads are past use, and the former preserved for the production of suckers for the following season. Suckers flower sooner, and the advantage gained is a crop of flower heads a fortnight or three weeks earlier than when seedlings only are used. This vegetable does not degenerate if seed is saved from flowers produced by the leading shoots of the plants raised from seed. A few of the largest flowers should, therefore, be annually reserved for this purpose.

On the hills the plantation need only be renewed every three or four years. When a stock has once been secured from seed, this should be done every third or fourth year by suckers, and the same plan followed as described for the plains. When the plants have to be raised from seeds, these latter should be sown in March or April, and transplated as soon as they have made four or five leaves. At elevations below 5,000 feet, suckers should be transplanted in September, but above that elevation, and especially if on a northern aspect, it should be done in March or April. At elevations above 6,000 feet, the stools should be protected from frost by a covering of stable litter or half-decayed leaves. In spring, when all danger from frost is past, the covering material should be removed and a quantity of old manure forked in between the plants. During the operation, uncover the stools and remove all the suckers except two or three of the strongest. At lower elevations manuring and removing suckers should be done in autumn; in spring and during their progress, all that requires to be done is weeding and occasional stirring of the soil.

W. G.

—*Indian Forester.*]

MINERALOGY.

Petroleum Supply of Baku.—According to a detailed statement on the above subject, lately made before the Berlin Association for commercial progress, by Professor Liebermann, there is at present a remarkable development of activity in the Russian petroleum industry. There are at Baku about 200 small distilling works, and also several large establishments. In the year 1881, there were distilled, at Baku, about 1,400,000 tons of raw naphtha, which yielded about 180,000 tons of illuminating oil.

The most important factory is said to be that of Messrs. Nobel, which has lately extended its operations, and has at the same time increased its capital from £900,000 to £1,500,000. The springs are about eight miles distant from their works, and the transport of naphtha is effected by a five-inch pipe, through which 1,600 tons are daily conveyed to the factory. It is intended to replace this pipe by one six inches in diameter.

The factory produced illuminating oils, in 1880, to the extent of about 22,000 tons; while, in 1881 and 1882, there has been a progressive augmentation to 50,000 tons and 90,000 tons. It is calculated that a further considerable increase of production may be expected during 1883 and 1884.

ASPHALTE DEPOSITS IN MEXICO.

A VARIETY of bituminous substances, from the pure hard asphaltum to the fluid petroleum, are known to exist in immense quantities along the coast of the Gulf of Mexico, chiefly in the States of Tamaulipas, Vera Cruz, and Tabasco, but there appears to have been no organised efforts to utilise the deposits, either for domestic purposes or for commerce. Consul Cassard, of Tampico, says that almost inexhaustible beds of asphaltum exist on both banks of the river Thamesil, about sixty miles above that port, being found in a comparatively pure state and containing only an insignificant proportion of foreign matter, chiefly vegetable which it gathers while through oozing the sedgy borders of the river. The substance may be gathered with little difficulty, but as the locality is only accessible to boats of light draught, the beds are comparatively neglected. Asphaltum, or *chapopote*, as it is called in Mexico, is frequently found floating in masses on the rivers and lagoons, and is cast up on the beach by the waves all along the Gulf Coast, and especially in the vicinity of Tuxpan, and on the Grijalva river in Tabasco. These masses, by the local law of flotsam, are the property of the finder, and are sold at the rate of from eight to nine shillings the hundred-weight. In the state of Vera Cruz asphaltum is found in considerable quantities, the principal deposits being in the canton of Jalacingo, in Minatillan, in the canton Ozuluama, where several deposits of petroleum, asphaltum, and coal are known to exist in a place called El Chapopotito, in the municipality of Panuco, in Papantla, in Tuxpan, and Temtoyuca. In Vera Cruz, near the village of Moloacan, a few miles distant from the river of Coatzacoalcos, there is an immense deposit of asphaltum, which, at some places, is found pure and at others more or less mingled with rock salt and saltpetre. According to Dr. Hechler, a German traveller who visited it, the "salt mine," as it is popularly called, is an isolated spur, branching off from the main ridge, or cordillera. This mountain is from 1,000 to 1,200 feet in height, and with a base of from three to four miles in extent, of cone shape and cracked by earthquakes; on its slopes are found a number of pits, some cold and still, others seething and bubbling, and emitting a stifling odour. These pits appear to have cavernous communication with the internal fires of the mountain, which, as indicated by the external heat and frequent subterranean noises, contain vast masses of material in a state of combustion. The whole adjacent surface consists of asphaltum partly solid, and partly liquid, and more or less mixed with rock salt. So extensive are these beds that the supply may be considered inexhaustible. In some places the seething pits eject considerable quantities of asphaltum in a liquid state. Extensive beds are also known to exist in the State of Chiapas, on the upper waters of the Grijalva river, which has its course through the State of Tabasco, and empties into the Mexican Gulf, near Frontera.

TOBACCO.

French Tobacco Statistics.—The consumption of tobacco in France is rapidly increasing, and last year showed no exception to the rate of progression, the quantity consumed amounting to 941 grames (about 21 lbs.) per inhabitant, and presenting a value of 9fr. 76c. (7s. 9¾d.). In 1881 the quantity consumed was 925 grammes (20¼lbs.) per inhabitant; in 1880, 907 grammes (under 20lbs.); in 1875, 855 grammes (under (19lbs.), worth 8fr. 58c. (6s. 10½d.). According to the returns of the indirect taxes direction, the sales in France during 1882 produced the following amount:—Tobacco for smoking, 164,930,180fr. (£6,597,207); of inferior quality, 23,209,577fr. (£928,383); common carotte, 5,765,870fr. (£230,634); cigars, 57,758,948fr. (£2,310,358); for chewing, 8,617,610fr. (£344,704); cigarettes, 16,767,318fr. (£670,692); and snuff, 78,229,507fr. (£3,129,180): making a total of 355,339,019fr. (£14,213,560).

TOBACCO-GROWING.

MR. W. W. SANDERSON, of South Deerfield, Mass., in a letter to the *Tobacco Leaf*, gives some of his experience as a tobacco grower as follows. He says:—

My success in growing this variety is due more to improvement in quality of seed and careful cultivation than all other items. I have grown Havana seven years and in only one instance (and then one-half acre) have I obtained less than one ton to the acre. I take run-out grass land, and plough it soon after haying very shallow, and plough again seven or eight inches deep just before the ground freezes, and then apply two or three bushels of dry slaked lime, and in the spring harrow thoroughly, and in May plough in ten or twelve cords of good barn-yard manure. When the plants are nearly large enough to set out, harrow fine, and furrow out rows three feet apart, and strew about two or three cords of fine manure in the furrow and five to eight hundred pounds of Peruvian guano, and cover this with a ridger that will leave the hills 22 inches apart. The fertilizer must be nearer the plants than for seed leaf. Keep clean and cultivate often, and have soil loose between the the rows.

Sucker clean and top high. A good or perfect crop cannot be secured unless it is suckered clean, as suckers suck the juice absolutely necessary to perfect the leaves.

Let it stand four weeks or more to ripen after topping, and hang with twine or hooks, as Havana is hard to lath, and, besides, cures too quick. The slower and darker it can be cured the better. Do each part carefully and well.

Take down and strip only when in just the right condition and make neat single bundles of ten to twelve pounds each. Tie with two strings if Havana, and three if Seed leaf, keep the butts even and tips straight, and you can always sell at a good price in the bundle.

I always sell in the bundle at from 16 to 20 cents, and others can do as well, if not better.

About ten years ago I believed improvement could be made in tobacco by selecting in some way the best seed, and adopted the following method, which proved my theory with Seed leaf, and for the past seven years with Havana Seed: Select best plants, remove all suckers, and when a few of the earliest seed pods turn brown, remove all the blossoms and seed pods not full ripe, and the strength of the plant is concentrated in making the seed plump and strong, instead of large in quantity. When the seed is ripe, shell it, and then carefully winnow it several times, removing from 1 to 2 of the lightest seed, causing the plant to give you the most perfect seed. By this method you get a better quality and more weight.

I have sold large quantities of seed raised in this way, and it always gave satisfaction. I read a paper this past winter to an audience of Suffield tobacco growers, which I hope will result in helping to regain the reputation of the Connecticut tobacco. At present Seed leaf will not supply the demand for fine wrappers, and Havana Seed will, being far superior in flavor and quality, and nearly equal in wrapping capacity to Sumatra. I have used first, second, third, fourth and tenth year's growth of Havana Seed, but recommend the tenth year's growth.

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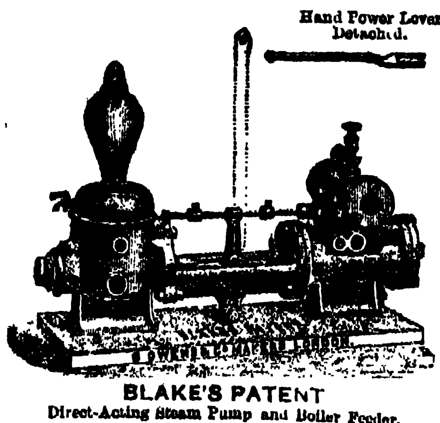
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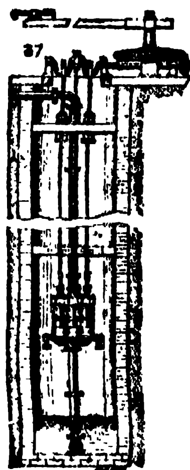
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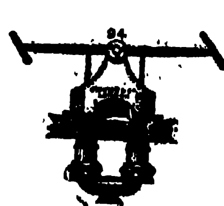


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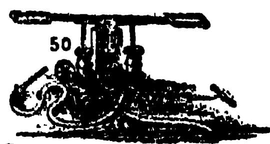

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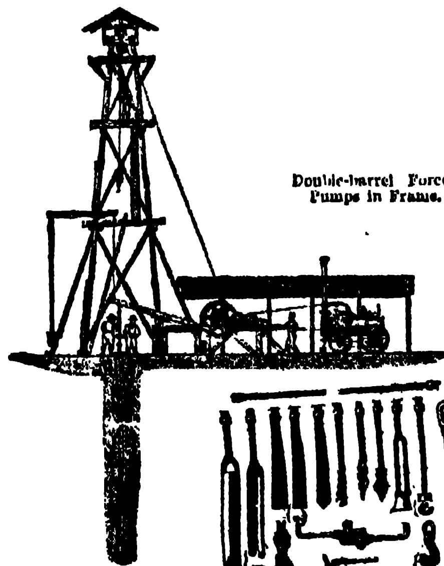


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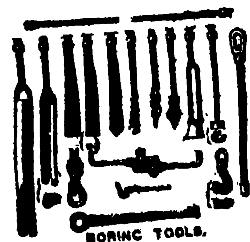


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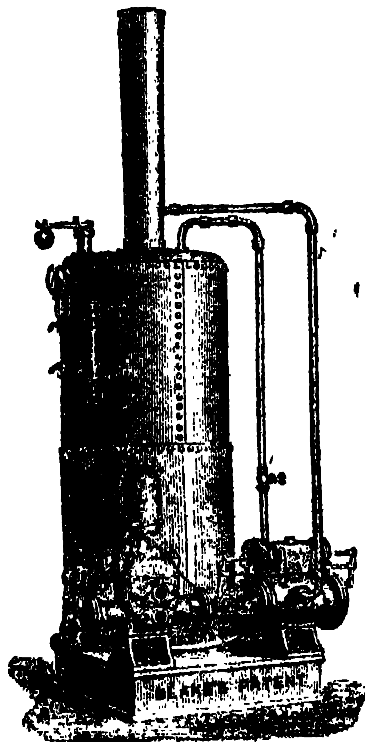

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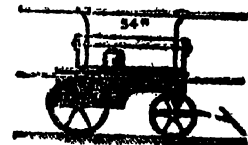

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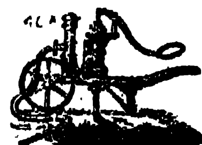


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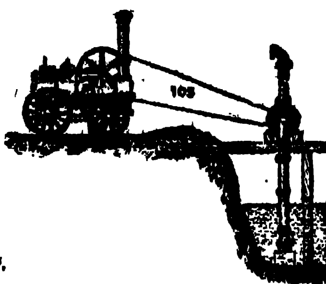


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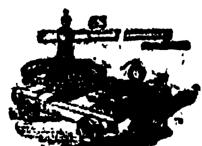
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THE

INDIAN AGRICULTURIST.

A MONTHLY

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VOL. VIII.] CALCUTTA :—MONDAY, OCTOBER 1, 1883. [No. 10.

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CONTENTS:

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGMENTS.

Report of Police Administration in the Punjab for the year 1882.

Report of the External Land Trade of the Punjab for the year 1882-3.

Records of the Geological Survey of India, Vol. XVI, Part III, 1883.

Report on the Nagpore Model Farm, in the Central Provinces, for 1882-83.

Report on the Administration of Civil Justice in the Punjab and its dependencies, 1882.

Report on the Sanitary Administration of the Punjab, 1882.

Annual Statement of the Trade and Navigation of British India, in the year ending 31st March 1883.

Report of the progress and condition of the Government Botanical Gardens at Saharanpore and Mussoorie for the year ending March 1883.

CORRESPONDENCE.

INDIAN SUGARCANES.

TO THE EDITOR.

Sir,—Could you or any of your correspondents inform me if there is any standard work, or scientific authority which would enable me to obtain a correct identification and the technical nomenclature of the different kinds of sugarcane grown in India? The author of *Tropical Agriculture* enumerates more than thirty different kinds grown in India, China, Mauritius, Bourbon, Africa, Australia, Egypt, West Indies, North and South America. Herr Schrottky in his work mentions two or three distinct species, but it does not appear whether they are identical with any grown in Northern India.

In this, the (Jullundhur) *Doab*, there are I know six distinct kinds met with, *viz.*, *Chann*, *Kanara*, *Ekar*, *Dhaulu*, *Kahu*, and *Ponna*.

(1.) The *Chann* is a thin slender cane with a pale brown color streaked with purple, rich in juice, and saccharine matter, the juice, having in well cultivated lands, an average density of 10·5° *Beaumé*.

(2.) The *Kanara* in native estimation ranks next to the *chann*, but is cultivated chiefly in the submontane tracts, the Siwaliks, and lower valleys of the Kangra districts. It is softer to crush, is rich in juice and saccharine matter, and has a pale, greenish color, and gives a very fair sugar.

(3.) The *Ekar* is a very inferior description of cane, hard to crush, and its cultivation is being generally discontinued throughout the *Doab*.

(4.) The *Dhaulu* ranks next to the *kanara*; it attains a much larger size than the three preceding varieties, it has a pale green color, hard to crush, rich in juice, but deficient in saccharine matter, juice rarely if ever exhibiting a greater density than 7·5° *Beaumé*. The *dhaulu* is, as far as I was able to ascertain from comparison with some specimens of cane specially procured from the Aligurh District, identical with a kind known down-country as *Saharanpuri*.

(5.) *Kahu* is grown extensively in the Bari Doab, more especially in the Goordaspore district, it has been introduced into the Dosuryah tahsil (Hoshiarpore district) and was tried for the first time in the experimental farm at Hoshiarpore at the instance of Mr. Coldstream, the then Deputy Commissioner. It attains a large size, about three inches in circumference, with a height varying from eight to nine feet; the color is a pale green, streaked with violet or purple. The yield in juice is good, and the juice has an average density of 10·5° *Beaumé*. I may add that the experiment of last year was conducted on a *small* area, not more than 0·17 of an acre, and the results which were good should on that account be received with caution: this year's crop will enable us to see whether the heavy outturn of last season, 47 maunds or 5,360lbs. of *goor* to the acre, was merely an accident, due to the unsafe practice of calculating produce off small areas, and accepting the results as reliable factors for general application.

(6.) The *Ponna* is grown all over the Punjab but seldom for conversion into sugar, generally being reserved for use as a sweetmeat to be eaten raw. It is too well known to need description here, but the question has often suggested itself—Why do not the natives crush it for sugar? It attains a large size, very juicy and sweet. It is a very expensive crop to cultivate, inasmuch as it requires an enormous amount of water to bring it to maturity.

The *chann*, *kanara*, *dhaulu*, and *ckar* can all be grown on good land without much irrigation, the ordinary rainfall being generally sufficient to develope the crop; whereas *kahu* requires watering at least once every ten days during May and June until the rains set in, and should get at least two waterings between October and the end of December in order to preserve it from frost.

The cultivation and preparation of the land is the same for each kind, but I found that whereas an acre of *chann* can be sown with 20 it takes 40 maunds of seed to sow an equal area with *kahu*.

In converting the *kahu* into *goor*, a *Mylne and Thomson's* mill was used, evaporation and *concentration*, if such it can be termed, being effected in a *karaha* or open pan.

It was found that the ratio of juice to cane was on average 72·75 per cent, which was of course very good.

The juice was strained through thick cloth at first, but latterly through *flannel*: it was then emptied into a space *karaha*, treated with one ounce of slaked and screened lime, well pulverized, made into a cream with water; a *slow* fire maintained until the *scum* and all *mechanical* impurities present had risen to the surface: the juice was then emptied into another pan and a steady fire of *megass* and cotton stalks maintained, until the proper degree of concentration, about 25 Beaumé was arrived at; it was then run off into a cooler and allowed to attain the crystallized mass and formation known as *goor*. It had a bright *golden* colour, presenting a marked difference to the *goor*, *clarified* with *sieklai*.

Seiklai is the bark of the *acacia arabica*, "*babul*," pounded up and made into a paste with water.

A considerable amount of chemical impurities must remain in all juice so rudely clarified, animal charcoal on defecation by *sulphurous acid gas* being the most efficient means hitherto used to remove the fecula, wax, and to neutralize completely the salts of potash, soda, and magnesia existing in cane juice.

Another great defect in the native method of *open pan* evaporation, is the waste of fuel and the great heat applied to the juice during concentration: in a *vacuum pan* the temperature rarely exceeds 150° Fahr. (65·5 Cent). hence the superiority of the sugar, the large *volume* and *well defined* form of the crystals.

The results obtained during the experiments on the *kahu* have impressed the natives with the idea that it is a staple worthy of more general and extended cultivation. And there are grounds for assuming that in course of time this variety will to a great extent supersede the *chann* which is now most generally cultivated.

If there is one industry more than another which should attract English capital into India it is sugar, labor and fuel being cheap, and practically no competition, there being only two *usines* in the whole of Northern India—Shahjehanpore, and Sujanpore on the Baree Doab Canal.

A small *usine* capable of turning out 5 tons of sugar per diem, on the produce of about 3 acres, equal to say 150 tons of sugar per mensem, would, if properly managed, yield a very fair profit; considering that French *usines* in *Martinique*, and English factories in *Jamaica* and *British Guiana* have, where fuel and labor are dearer than in India, been known to yield as much as 25-30 per cent on *paid-up* capital, there is no reason to assume that an equal measure of success should not be attainable in Upper India.

A properly conducted *usine* should be able to supply good sugar to the people at large and turn out a fair drinkable liquor. If the Aryan brother is to get drunk, it is far better that he should get drunk on good sound *cane-rum*, than on the adulterated abominations sold in the *bazaars*.

That the establishment of a sugar factory in the heart of a sugar-producing district would be an unqualified blessing to the cultivators, is a question not admitting of a single doubt.

A native *belna* will work off an acre of sugar-cane, or say 40,000lbs. of cane in about 45 days, the boiling, cooling and other processes taking an interminable time, the refined sugar not coming into the market till about the following May.

A native *belna* has not a higher extractive power that 55·60 per cent, so that assuming an acre of sugarcane to weigh 40,000lbs., we should get 24,000lbs. of juice, and allowing 8 per cent of this to be dry sugar we get 1,920lbs. as the gross outturn, and 1,920=80÷24mds. sugar, selling, say at 16 per maund, total value—Rs. 354.

An English machine turned out by any good maker, such as M. M. Walker Henderson and Co., Glasgow, Buchanan & Co. London, or other large firms too numerous to mention, will give an extractive power, or rather and more correctly speaking, give an extractive power nearly 80·85 per cent, so that for our 40,000lbs. of cane we should get 82 per cent of juice, or 32,000lbs. and what is more of a higher density than from the native *belna*, so that we might calculate on something like 2,500—2,750lbs of dry sugar, which would be (at the same rate as before) worth Rs. 500.

Hence, irrespective of the very important consideration of cheapness of manufacture, the *usine* can get more out of an acre of cane than the zemindar or village *shah*, consequently the *usine* can afford to pay more for the cane than the native manufacturer.

But the advantage to the zemindar does not cease here. It takes him nearly six weeks to work off his acre of cane, whereas a *usine* such as I have described would run this cane off in *half as many hours* with the greatest ease—in fact, faster than the cultivator could supply it even with 20 carts working. The aquatic weeds alluded to by your correspondent in your last issue, when discussing the sugar-producing capabilites of the Doab, are *Vallisneria Spiralis* and *Potamogeton Crispus*.

Let us hope, now that our Aryan brother is about to be *politically* educated by means of *Local-Self-Government* and *Native Jurisdiction Bill*, his *intellectual* and *social* education may be taken in hand as well, and that he will be able to dispossess his mind of many prejudices which preclude his availing himself of the advantages modern science places at his disposal, he may then ascertain for himself the important truth that there are easier means of winning purgatory and courting social ostracism than by eating sugar, *refined by animal charcoal*.

C. S. F.

EXTRAORDINARY CASE OF A BUFFALO-COW SWALLOWING A STEEL SPINDLE.

TO THE EDITOR.

SIR,—The following particulars of this unusual case may interest veterinary readers:—

On the 11th of July last, a buffalo-cow in very prime condition and about seven months gone in calf, the property of a cultivator in the Agra district, N.-W. Provinces, finding herself near a spinning wheel, and prompted no doubt by her evil genius drew out the steel spindle by the roll of newly prepared thread that was on it, with the intention of eating the thread only we presume, but in swallowing this she took down the spindle with it.

Great was the distress of the owner, for she was of a valuable breed. "Ah! unfortunate," he was heard to say, "I suspected that your vile habit of making a masticatory of every bit of cloth and paper you came across would bring you to grief in some way, but little did I think it would lead you to swallow a sword." All the cow-leeches in the neighbourhood were appealed to, but their pathology contained no rules for the treatment of such a case, and the only consolation he received was, that cattle generally died when they swallowed a needle only two inches or so in length, and that cattle-poisoners found that throwing a needle into the fodder of their intended victims was one of the safest ways of ensuring their demise.

Left to his own resources he ground down some load-stone, and made the cow drink it; not that he thought that it would do much good, but simply because he was hanged if he could think of anything else. He also went to great pains to secure a large horse-shoe magnet, and was found in the act of moving it about her body in a listless manner in the hope forlorn that the spindle would be attracted out.

For the first 8 days she would not eat anything, and for 10 days after was kept alive by hand-feeding with wheat chaff, for she would not touch grain of any sort; after this she commenced eating herself, but only a little green grass and wheat chaff. By the 9th September, 60 days after swallowing the spindle she was reduced to a perfect skeleton, but on this date a swelling, about an inch and-a-half high and 8 inches in diameter, appeared suddenly about midway on the right flank, so low down as to be almost under the stomach, which for the first time gave an idea of the whereabouts of the spindle. This morning, the 10th September, the owner in passing his hand over the swelling felt the sharp point of the spindle projecting just a little out of the skin about 4 inches away from the anterior edge of the swelling.

The village goldsmith, with his wire-drawing tweezers, soon extracted and exposed the spindle to the gaze of the delighted villagers. It was brought to me this morning, and I examined it carefully. It was just 14½ inches in length and ⅛ of in inch in thickness in the middle, from which it tapered on both ends down to very fine points.

About 8 inches of the spindle was quite straight, and the other portion, on which the cotton had been rolled, was twisted, and bent by the action of her teeth. The cow is doing well.

W. E.

THE CALISAYA CONTROVERSY.

(*To the Editor of the Planters' Gazette.*)

SIR,—My time has been much occupied in the last two weeks in Quinological pursuits, and in returning your papers I send some brief notes. I am correcting, whilst passing through the press, my contribution to the subject, which will shortly be published by the Linnæan Society. To this *so corrected*, I must refer you, in place of newspaper reports. I am availing myself of a visit of Mr. C Ledger to this country to go carefully into the whole question with him and Mr. Holmes, the Curator of the Museum of the Pharmaceutical Society, and with others interested in the cultivation of Calisaya.

It will interest your readers to learn that Mr. Ledger is quite satisfied with my plants derived from the Yarrow Estate (Ceylon) as representing his true *Rojo* or red sort; resting his opinion on the characters I pointed out at the Linnæan. He says that the beautiful richness of the foliage remains, especially in those parts of the tree which are least exposed. It is this sort to which the Indians attach so much value that they cross themselves when they meet with a tree of it and call it the *Tata* or "Father" tree ibelieving (as I think not without reason) that it has a beneficial n fluence on all around, and that all be found "Calisaya" or true bark.

Mr. Ledger cannot tell what this word means, but Dr. Weddell, who spoke the Indian language, says (in his "Histoire," p. 31) that it means "the red sort," "Colli signifie, en effet, *rouge*, en langue Quichua, et *saya* paris au figuré, veut dire 'sorte' ou 'forme,'" or (as I gather from Tschudi's German Dictionary of the language), *Cooli*, * "the red of glowing embers." *Saya* "*Stehen.*" Mr. Ledger fixed upon a slab of Calisaya in my possession nearly three-quarters of an inch in thickness as the true and highly prized *Rojo*. He tells me that Dr. Neddell had heard of the white flowers, and sought for them, but without success. To obtain this "red sort" has been the special aim of Mr. Ledger, and by *special* policy he was able to defeat the jealous tactics of the Indians, who boast that no one that obtains true seed shall leave the valleys alive. They either supply inferior qualities or destroy the germinating power. They laid wait for five days for Mr. Markham, who escaped through a Providential circumstance, and they poured boiling water on my friend Dr. Weddell's plants, who was profoundly affected by the outrage.

This *Rojo* is, then, the true *Ledgeriana*, as, in looking over my old letters, I fully recognize. Mr. Ledger sees it represented in my Plate IV. or the *Macho* form A. He does not see it in form B, or in the plant I have from Darjeeling which I think is probably the same B form. I have, in all, nine specimens of Java trees from Ledger's seed through the hands of M. Moens. There are different varieties in these, which Mr. L. does not recognize, but which are reproduced in specimens from British India. I should say, that his faithful Indian employed his own sons in gathering seed from fifty trees in different places, and the different collections got afterwards mixed together. The whole appeared to me to present Weddell's var. microcarpa.

Mr. Ledger entirely rejects my *Micrantha Calisayodies*; as also Dr. Trimen's plate. The colour of the changing leaves, he says, is exactly that which I copied from nature in the Calisaya Anglica, and the rich colouring of the leaves is perfectly given *there*, but the form of the leaves is, as above described in form A. When, as in the C. Succirubra, the leaves turn this rich red colour, it is generally connected with rich colouring in the green of the leaves. This is a feature on which Ledger lays great stress, and it appears that many of the leaves assume this tint at the time of flowering. Hence the term *Colli* (Quichua) *Rojo*), (Spanish), *Roju* (French),

Now, is this "red sort" a different specie from the Calisaya? It is not distinguished by the bark, for where the *Tata* trees are found (single amongst the *manchas* or patches) all the bark is good, owing, according to the Indians, to some connection with these chief trees. This is what I find in the specimens sent me by M. Moens from Java. Most are of equal quality to the true *Rojo*, some superior, others indicating, by proportions of Quinidine or of Cinchonidine, the influence of inferior pollen.

* The verb signifies to cover a fire with ashes so as to retain the glow.

The slab which Mr. Ledger pointed out as typical *Rojo* I have marked *Zamba*,* a name belonging, as I thought, and Weddell confirmed this, to this *var Microcarpa*.

I cannot make all this fit in with what is called "*correct* botanical description," which seem to be consistent with leaving out all allusion to the bark in the description of the Bark Tree; as in Bonpland's most confusing account of his *Condaminea*. The Spanish botanists and Weddell were most particular to collect samples and carefully to describe the bark. I have approached the subject *from the side* of the bark, and consequently consider this the chief factor in the problem. I think practical cultivators will agree with me in this. My term "Ledgeriana" was meant to include all the bark of a certain rich quality grown in Java from Ledger's bag of seeds, and called such in trade. But the true *Ledgeriana* must be the *Rojo* of Ledger, and again I ask what is that? It is the form A of my Quinology, that is, the *Macho* form, distinguished, as Weddell shows (p. 31, Histoire) all such forms are by richer colouring (the purple of the under side, however, is accidental); and, as I think, by its furnishing prepollent pollen needed to keep up the superior strain of these best qualities. Without this, they would degenerate, as in an analogous manner is the case with animals. The Indians, by long observation, are nearer the mark than the scientific botanists!

These are questions for practical cultivators. By a kind of reversal of the process above hinted, my gardener obtains for me *degenerate* cucumbers, *i. e.*, *without seed*, and consequently sweeter, and devoid of the strong principle which disagrees with some persons. By careful fertilization, he keeps up the strain of my melons; and by artificial impregnation, requiring skill, he succeeds in growing beautiful pods of Vanilla, equal to the best in the market.

I would always have a sprinkling of *Tata* trees in my plantations of Calisaya, and should then count on having *all* of what the Indians call true *Calisaya* quality.

I remain, yours, &c.,
JOHN ELIOT HOWARD, F.R.S., F.L.S.

The Indian Agriculturist.

CALCUTTA, OCTOBER 1, 1883.

INDIGO.

MUCH has been said during the past twelve months about *artificial indigo*, and much about chemical and mechanical processes for augmenting the yield of the natural dye. Generally speaking, the former has been stigmatised by manufacturers and others concerned in the latter as at best but a poor imitation. They take the word *artificial* in its literal sense, and refuse to believe that artificial indigo is identical, chemically as well as physically, with the indigo of agriculture. The few who acknowledge it to be one and the same assert that its price must for a long time keep it without the pale of competition. It is useless to attempt to convince persons holding these views. They, naturally perhaps, do not wish to realise the truth. We, however, positively set it down, that artificial indigo stands exactly in the same relation to the indigo of agriculture, as does ice naturally formed in northern latitudes to that formed by means of chemicals in the east. Just as we can, by exploding the gases hydrogen and oxygen in certain proportions, form water, so can we bring together from various sources the elements of indigo, and resolve them into indigo. This position being impregnable, it is to be hoped that the disastrous season just closed will tend to open the eyes of those concerned, to the consequences of an advance in the home market of the artificial material. It is true that the processes at present followed in its manufacture are tedious and expensive; but it is reasonable to expect that, like most things owing their origin to the ingenuity of man, it will speedily be brought within the reach of all classes, a consummation, of course, anything but devoutly wished by those engaged in the manufacture of the natural dye—a consummation, however, *which they are not altogether powerless to avert.* No advance has been made either towards the comprehension of the thing itself,

* Le plus riche en Quinine de tous les Quinquinas dont on ait publié, jusqu'à ce jour, les analyses."—Bulletin de la Société Botanique de France, 9 Mars, 1855.

the superior variety may be found to thrive in the same neighbourhood. It is one of the most highly nitrogenous or towards an insight into processes the adoption of which would, for a time at least, effectually check its development, that is, by those most able to deal with them. It rarely happens that an individual influence or cause presents itself in an isolated form. The discovery of artificial indigo was followed by the utilization of a bye product of aluminium manufacture, equal in all respects, except *softness of lustre* to indigo. The monopoly of this dye was purchased by a member of one of the largest firms of indigo brokers in London. This, it might be inferred, coming so fast after the more important discovery, would have roused manufacturers of and speculators in natural indigo, into action. These discoveries, together with reliable reports as to increased sales of indophenol, methylene blue, alizirin blue, and other by no means despicable substitutes for indigo, they have treated, if not with actual contempt, at least with the most glaring indifference. Another influence has now cropped up, which, taken with those which have gone before, point to considerable charges in the indigo industry of India. We are in a position to state that steps are at present being taken to cultivate and manufacture indigo on a very large scale in countries not very remote from India, and that certain *proved processes* guaranteeing from 50 to 100 per cent increase in yield, above the ordinary process of manufacture, will be adopted. These processes were offered for sale in Calcutta, and rejected on all sides, with the result, that competition has been set up of a kind not hitherto experienced, and on which we are not at present permitted to dwell, more than to say that such will be under trained Indian management, and that all the newest improvements with regard to machinery and culture will be adopted. We shall of course be debarred from using the patents alluded to in India, for it is most unlikely that the patentees will grant royalties under the circumstances stated—that is, to people whom it is their purpose to oppose. The out-look, therefore, from India is not at all pleasant in view of the drawbacks peculiar to climate, the gradual reduction of the artificial product at home, and the competition alluded to, with advantages *now* beyond our reach to be set up away from us, but sufficiently near to be felt. Our ultra-Indian competitors, from being able to manufacture cheaply, will doubtless establish the rates. They will sell 50, 60, and 70 per cent indigo at a profit, while we dispose of it at a sacrifice. It may be said that it will take a long time to overstock the market to such an extent as to necessitate reduction. So much the better for our ultra-Indian competitors. They will reap large profits, while we barely subsist, and by the time that we begin to realise the fact that we have from the beginning avoided information most accessible, and refused processes most intelligible, the artificial product will be in full operation against us. We have said that we are not altogether powerless to avert this calamity. But we doubt very much whether it would improve matters were we to explain how, for we have come to the conclusion that the few speculators who at present rule the market are not so shortsighted as they appear. Contemplating, perhaps, early retirement. They say to themselves, "The devil take the hindmost." "Explain your patent improved processes to our successors." Whether this is fair to the manufacturers, who are in many cases financed and advised by them, is a question which they themselves must consider.

We can well understand that it would be much more satisfactory for those at present interested to go on in the old way; but as it is becoming widely known that not one of the multifarious blue dyes offered to the public as substitutes for indigo, can compare with such in exquisite softness of tint, it is to be expected that workers in science will leave no stone unturned to produce indigo at a price which will create an immediate and large demand. Our obvious duty, under the circumstances, is to obviate this necessity.

This we will not do by treating inventors with scorn, and driving them disgusted from the country. It seems almost beyond belief that in this City of Palaces, this nursery of merchant princes, the capital of a province identified with the indigo industry, there cannot be found a capitalist, or body of capitalists, willing to launch a company to work patents of such high promise, say, as Michel's. "I don't believe in your chemicals!" is a frequent iteration of persons opposed to improved processes. The expression, it will be seen, is a hackneyed one. "You may get an increase," they say, "but the colour *must* be bad." This is the logic that science has to contend against. Quinine is obtained from cinchona bark, it is obtained from the bark by means of chemicals, *ergo*, it cannot be the same as the quinine dissolved out of the bark by water. The same might be said of hundreds of valuable drugs which have to be extracted by chemical means from the plants in which they are developed—drugs a thousands times more delicate than indigo. To make indigo, then, an exception, is simply to subordinate Western intellect to Asiatic fancy, or, as we have before hinted, it is purposely excepted. There is a consequence to which the collapse of the indigo industry will lead, which demands more than mere passing attention—*viz.* the abandonment of thousands of labourers whose interests are totally bound up in it. History shows that the sudden collapse of an industry of this magnitude must be followed by serious results. It will, therefore, be well if Government give a closer consideration to certain complications which may arise, in the event of our conjectures with regard to the future of indigo proving more dismal than we care to presage. What we are especially in want of at the present time, is that criticism of the improbable, barely probable, and possible, which our manufacturers themselves are so well able to advance. We look in vain for this. Pig-sticking and horse-racing are evidently more congenial pursuits. We are not of those who contemn sport—indeed, we should be the last to wish for any change in the present routine of an indigo-planter's life: but we do think that they should at times manifest some deeper interest in affairs pertaining to their vocation, ventilate their opinions and grievances, so that the true condition of things might be accurately judged, and the worst possible results anticipated. They have a journal specially representing their own interests, *The Indigo Planters' Gazette* elegantly got up, and well conducted. But it is a rare occurrence to see anything in the correspondence columns pertaining to indigo. Nothing points more strongly than this to the lack of interest exhibited by indigo-planters in their own affairs. For this reason, should calamity befall them, should this great staple take its place in the obituary of commercial products, scant sympathy will be shown them.

One year ago artificial indigo was not found in commerce in an isolated state, that is, in anything like the form of the indigo of agriculture. It was sold as a paste, called propiolic acid, and from this, was developed, on the fabrics to be dyed, pure indigo. A few months ago the Baden Chemical Company succeeded in producing a liquor *of a deep yellow colour*, from which, *on exposure to the air*, indigo separated out.

THE NAGPORE MODEL FARM REPORT.

THE two points that seem to call for most prominent notice in the Report on the Nagpore Model Farm for the year 1882-3, are the change of system and site, and the attempt to introduce Kachi cultivators from Cawnpore. Before dealing with either of these topics, we have a word or two to say regarding the various hands through which reports on purely agriculturals matters pass. The Nagpore Model Farm Report is as good an example as any of what we mean. The Central Provinces has a Director of Agriculture who, we may suppose, is responsible for agricultural matters over which Government money is expended. The report of the farm is written by the person superintending the farm, and passed on to the Provincial Director of Agriculture. He in turn writes what amounts to a review of the report, and passes both on to the Secretary of the Chief Commissioner. The latter, in a letter to the Director of Agriculture, writes what is virtually a resolution on both documents, and the three deliverances are printed as Model Farm literature. We do not wish to question the wide knowledge and capacity of Indian Secretaries. There is scarcely any topic under the heavens or beyond them on

which they are not able to write a tolerably readable essay, and should the matter be unusually technical, their deficiency of knowledge may easily be covered under generalities and a cloud of words. No doubt it is in some respects highly desirable that the rulers of provinces should exercise supervision over all operations in which Government money is expended, but in the case of Agricultural Departments it seems to us that while the responsible officers of the Local Governments should in every case be consulted and hold the power of the purse, nevertheless, the Director-General of Agriculture is the person to whom the reports of the various provinces should be submitted. A general report, embodying what is valuable in provincial reports and passing in review the operations of each provincial department, would we, venture to think, be a valuable addition to the literature of Indian Agriculture. We are quite aware that the policy of the present Imperial Department of Agriculture is to leave a good deal, in fact, nearly everything, to provincial, departments, and confine itself mainly to suggestions, to the collection of facts and information, and to the noting of useful experiments. A good deal no doubt can be said in favour of this, but in our estimation all matters agricultural, even to the reviewing of provincial reports, should be more or less under the control of a central office, ready at any moment to supply information of what is being done in every part of India in matters agricultural. There is another matter, we think, which calls for attention in connection with the Nagpore Model Farm. The net cost of the farm is less than that of the previous year by Rs. 2,115-5-7, the reduction being due to saving effected by placing the farm under Colonel Lugard's unpaid management, instead of retaining a European Superintendent. Colonel Lugard, the Deputy Commissioner, one would imagine, could find sufficient occupation in his district without taking on his shoulders the responsibility of superintending a Model Indian Farm. No doubt the persons who advised and confirmed such an arrangement are prepared to prove a hundred times over that it is the best of all possible arrangements financially, scientifically, governmentally, philosophically, and every other way; nevertheless, the non-official heathen lying in outer darkness will blaspheme and will not dance to the pipings of Directors of Agriculture or Secretaries of Chief Commissioners.

Turning to the matters noted at the opening of this article, we find the Director of Agriculture of the Central Provinces saying :—

"In the reports for the past eight years the unsuitability of the farm site for experimental agriculture has been often strongly insisted upon, and this opinion is corroborated by Colonel Lugard's experience. During the year under report, it was accordingly determined to discontinue Government farming altogether on the Model Farm site, and to limit agricultural experiments in future to a smaller, but much more favorably situated tract of land lying immediately south of the 'Maharaj Bagh.' 'Model' farming on a large scale will not be attempted in future, and all that will be aimed at is the careful conduct of experiments on a sufficiently large scale to render the results reliable. Experimental farming on this new site has already been started. Part of the area of the Model Farm has been disposed of by lease to cultivators. Part will be utilised as a sewage farm for Sitabuldi and the Civil station of Nagpore, and for this purpose a tract has been reserved of sufficient area to utilize the whole of the sewage and of the irrigation water available."

In this conclusion we heartily agree, and hope in future reports to see good results following from such sensible determinations. The attempt to introduce Kachi cultivators—is succinctly described by the Director :—

"Very little agricultural use is at present made of the sewage of Nagpore, and the income which the Municipality derives from it is quite insignificant. The Kunbi cultivators round the city are strongly prejudiced against using it, and are quite ignorant of the manner in which it can be used to best advantage. It was therefore determined in June 1882 to import some cultivators of the Kachi caste from Cawnpore, and endeavour to proselytise the Kunbis through their example. Twelve of these men were accordingly brought down ot Nagpore, and were at the outset entertained as paid labourers on a very liberal rate of salary. They promised exceedingly badly, and were very idle and discontented. In September the three most obstructive of the number were sent summarily back to Cawnpore, and the rest were induced to accept an arrangement under which their salary was reduced from Rs. 7 to Rs. 4, and in return for this they were given four acres of land rent-free for nine months, with the right to use, free of charge, the manure stored in the farm sewage pits. At the end of this period all salary was to cease, and the land was to be assessed to rent. The crops which they grew under these conditions were exceedingly good, and gave them handsome profits. Their salary has now been discontinued, and they have accepted 6 acres of land on a five-years' lease at a progressive rent, which has been fixed at Rs. 5 per acre in the first, and Rs. 15 in the fifth year. This is exclusive of water rate, which is charged for separately according to the amount used. A portion of the Sitabuldi sewage is stored in pits close to their fields, and they are allowed to use as much of it as they please, free of charge, Government undertaking to maintain the supply. It is too early yet to speak with confidence of the future of the scheme, but I am glad to be able to report that their example appears to be having the desired effect on the Kunbi cultivators. The latter have from the first shown great jealousy of the Kachis, and within the last two months three Kunbis have come forward with applications for land on similar terms. Two of these applications have been accepted, and the men are in possession of their land. It has been expressly stipulated that they are to use the sewage with their own hands, and not to employ *Bhangi* labourers. The result of their cultivation may be expected to yield some really trustworthy data as to the agricultural value of sewage, the best method of utilizing it, and as to the value of irrigation when used in conjunction with it. There can be no doubt whatever that lack of irrigation is the principal obstacle to the proper utilization of city sewage in these provinces, and it may be possible to demonstrate that the value of water when applied to a sewage farm is sufficiently high to render it profitable to incur a considerable outlay in bringing it on to the land."

REPORT OF THE GOVERNMENT BOTANICAL GARDENS AT SAHARUNPORE AND MUSSOORIE.

THE Report on the progress and condition of the Government Botanical Gardens at Saharunpore and Mussoorie, which has just come to hand, calls for a few remarks. The distribution of plants shows an increase of 35,688 over last year. The total weight of drugs has fallen off from 1,377lb. in 1881 to 616lb. 10oz. in the present year. The receipts were Rs. 7,095-9, as compared with Rs. 6,937 of last year. The net cost of the gardens to the State has increased from Rs. 19,871-15 to Rs. 21,919-2. This increase is mainly due to plants and seeds distributed gratis to soldiers' gardens and to an increase in salary to Mr. Gollan.

Perhaps the most important class of recent introductions to the gardens are the various kinds of plants that are especially adapted for growing on salt or sandy soils; of these the *Atriplex nummularia* has been distributed to Mr. Wilson at Awa and Mr. Impey at Cawnpore, and in both places has been found to thrive admirably on usar of the worst kind. A large quantity of seed has been sent for from Australia, and it may be the means of covering the now nearly useless stretches of usar in the Doab and elsewhere with a vegetation that will be of some use as a fodder for cattle, and of still more value in checking erosion, and gradually depositing a layer of humus over the barren salt. Besides this, the sand bush of South Africa, which flourishes in deserts and can survive a prolonged drought, may be found of use for the same purposes.

Mr. Benett, the Director of Agriculture, N.-W.P. and Oudh, hopes that among food plants the soy bean may become a success. The existence of an inferior native congener in the lower ranges of the Himalayas encourages the expectation that

forms of food known, and should prove a valuable addition to the food supply of the country. The yields of imported cottons were fairly good. New Orleans gave 220lb., Upland Georgian 206lb., and other varieties 160lb. to the acre. In calculating the value of the crop, the bazaar price of the native varieties has been taken ; but in the great cotton market of Cawnpore, the American realizes more than half as much again as the native fibre. The experiments made at Saharunpore confirm the results obtained on a much larger scale at the Cawnpore farm, and are chiefly valuable in showing that American cottons will thrive equally well in the different climate and soil of the former district. The coarse variety which was imported last year from the Garo Hills has not proved a success.

The following acclimatized and imported varieties of cotton were cultivated during the past year :—

Acclimatized.	*Imported.*
Egyptian.	
Garo Hills.	Louisiana.
Hingunghat.	Louisiana Prolific.
Nankin.	Georgian.
New Orleans.	Sea Island.
Tree Cotton.	Upland Georgian.
Upland Georgian.	

As in past years, says the report, the acclimatized varieties of New Orleans and Upland Georgian gave the best return per acre. The first named variety produced 8 maunds 10 seers and the second 7 maunds 30 seers uncleaned cotton per acre. The value of the crop, calculated at 8 seers per rupee, is Rs. 41-4-0 and Rs. 38-12-0, respectively. The cost of production was about Rs. 24 per acre, which, deducted from the total, leaves a balance of Rs. 17-4-0 and Rs. 14-12-0 profit per acre. I have valued it at the rate obtainable in the bazaar for the common country cotton. It is of superior quality when compared with the latter, and I have no doubt would command a much higher price if produced in sufficiently large quantity.

The Egyptian, Hingunghat, Nankin, and Tree cotton produced on an average 6 maunds of uncleaned cotton per acre. If calculated at the same value as the New Orleans and Upland Georgian varieties, and deducting the same amount for cost of production, the balance of profit left would only amount to Rs. 6 per acre. Under more favourable circumstances these varieties, and also the two first named, are capable of producing heavier crops. The plot in which they were grown had been for some years previously occupied by rhea, which is known to be a gross feeder. The Garo Hills variety germinated very badly. It was received rather late for sowing in the previous season, and the pods then produced evidently did not contain many perfect seeds. Only 40 plants germinated and produced two seers of uncleaned cotton. This is not a large quantity for the number of plants ; the yield, however, may improve when the plant becomes thoroughly acclimatized. The imported varieties gave a poor return, although grown under the same conditions as the acclimatized. They all germinated freely, but none of them grow to a height of more than twelve inches. They have all ripened, a few pods, and if the seed is properly developed may give better results next year. The fibre of the Sea Island is much superior to any of the acclimatized varieties we at present possess. If it can be acclimatized and made as productive as the New Orleans, it will be a decided acquisition. The Lousiana, Louisiana Prolific, Georgian, and Upland Georgian are all very much alike. The fibre of all four varieties is similar to that produced by the acclimatized New Orleans and Upland Georgian.

The following is Mr. Duthie's account of the silk-worm experiments :—

As the improvement of silk and the extension of this industry has lately been engaging the attention of the Government of India, I was induced to try a small experiment here in order to ascertain how far the climate of Saharunpore would prove suitable for rearing the silk-worms.

Two ounces of eggs were received about the middle of last February from Captain Murray, Dehra Dun. The first worms appeared on the 25th of that month, and the last were hatched on the 20th of March. As they were all kept in the same temperature, such irregularity in hatching seems remarkable. The worms were at first fed solely on *Morus multicaulis* ; but as the leaves of that variety of mulberry ran short, those of the common kind (*M. indica*) were given and were as eagerly devoured as the former. Leaves of *M. alba*, and of another variety with broad thin leaves, said to have been introduced from Kashmir, were also given, but the worms did not eat either of them so greedily as the two first-named. The total weight of leaves used amounted to 612lb. A less quantity would have sufficed if hot dry winds had not prevailed during the greater part of the period they were being fed. The leaves were often too hard and dry for the worms within half-an-hour after being supplied. The first cocoons were spun on the 23rd of March, and the last on the 23rd of April. The total number produced was 10,400, and their weight in a dry state was 9lb. 6oz. The following is Captain Murray's opinion on a small sample taken at random from this first batch of cocoons :—

" I took your cocoons to the silk exhibition held here last " Friday, to see whether they would come up to those raised in " the Dun. All I can say is that, if at Saharunpore you can " raise any quantity like those few sent to me, the people of the " district have an industry to their hands. I do not say your " cocoons are so good as those raised by my son, but they are " very good indeed." Two pounds of the cocoons were reserved for eggs, and the remainder killed by exposure to the sun. The moths from the seed cocoons have produced their eggs, and as they are of the bivoltine variety of silk-moth, another batch of worms will soon be hatching. Until this second batch has been brought to the cocoon stage the experiment may be said to be only half finished. The amount expended on the experiment up to the period when all the cocoons had been formed was Rs. 20. This amount is really the pay of the men employed in bringing leaves and tending the worms. The same amount of money would have sufficed for an experiment on a much larger scale. Mr. Gollan has personally supervised the experiment from the commencement ; all credit is therefore due to him (says Mr. Duthie) for its ultimate success.

The possession of a new site for the Gardens at Arnigadh has now been obtained with a cultivable area of 30 acres on a projecting plateau of a hill-side 5,000 above the sea, and the work of removing all that is worth moving is now being taken in hand.

EDITORIAL NOTES.

A CORRESPONDENT writes to us pointing out that the derivation of *Fijarat* from two Hindi words given last month in the leading article on Agricultural Banks is "as fanciful as it is incorrect." We shall be glad if our correspondent will furnish us with the correct derivation.

A PREMIUM of 6*d*. per dozen has, it appears, been placed upon sparrows' heads by the Government of South Australia, acting on the advice of a Commission specially appointed to inquire into the " sparrow question," while the somewhat disproportionate sum of 2*s*. 6*d*. per 100 is offered for the eggs of the bird.

THE committee engaged in the organisation of the Austro-German Exhibition of 1885 recently, it seems, addressed a petition to Prince Bismarck, asking for the support of the Imperial Government. In this document reference was made to the Austro-German Exhibition of Art and Industry, held at Munich in 1876, and to the opinion then generally formed, that the repetition of such displays in important cities would be of undoubted advantage. An interval of six to eight years was then spoken of as being the most suitable, but in this instance a longer delay has been inevitable, as Berlin was selected for the next Exhibition, and up to the present time that city has not possessed a fire-proof building of a suitable character. This difficulty having been removed by the erection of the Hygienic Exhibition, the suggestion was made in the document referred to, that this building should be utilised for the purpose indicated. According to the most recent

information published upon the subject in the German press, the proposal has met with the approval of the Chancellor, and of the Imperial Court. It is stated in the *Cologne Gazette* that the municipality of Berlin will, in all probability, take over or hire the principal building of the present Exhibition. In this case there would be held, in 1885, the proposed exhibition of industrial art; in 1887, an international trade exhibition; and in 1888 an electro-technical display. It had been at one time proposed to include France in the Exhibition of 1885, but this idea has been abandoned.

FROM a summary of the agricultural returns of Great Britain for the present year, lately issued by the Agricultural Department of the Privy Council, it appears that the acreage under the five main crops are—Wheat, 2,613,147; barley, 2,291,984; oats, 2,975,377; potatoes, 543,455; and hops, 68,027. As compared with the returns for 1882, there is a decrease to the extent of 390,813 acres in the case of wheat, but an enlarged acreage in the case of the other four crops; thus, of barley the increase amounts to 36,715 acres: oats, 141,512 acres; potatoes, 2,391 acres; and hops, 2,408 acres.

TANNING TEXTILE FABRICS.—M. Piron, a Belgian, has invented a process for tanning textile fabrics which renders them waterproof, and at the same time, it is said, proof against decay, while their suppleness is not diminished, and their weight not appreciably increased. Arguing from the high state of preservation in which the bands which surround the heads of Egyptian mummies are found to this day, and which are impregnated with a kind of resin, M. Piron had recourse to the substance extracted from birch bark, and which is now used to perfume Russia leather. When the fine white bark of the birch tree is distilled, it yields a light oil, nearly a fourth part of which consists of the special phenol, or carbolic acid, which gives the well-known odour to Russia leather. It is now found that the residue, or green tar of the birch, which is obtained from *Kostroma*, yields neither acid nor alkaloid, and it forms, with alcohol, a solution of great fluidity, which, however, when once dried, is unacted upon by alcohol. It is this substance, which will unite with the most brilliant colours, that is used by M. Piron for treating textile fabrics. Not only does it fill the capillary vessels, but it also coats them with a varnish of great elasticity, which is unattackable by acids and sea water, while it also stands great changes of temperature. The aromatic odour of articles thus treated drives away insects; there is no space for microscopic vegetation, and neither air nor water can penetrate into the tissues. This process is applicable to all vegetable products, such as sail-cloth, cordage, blinds, and awnings.

THE current number of the *Jamaica Handbook* contains valuable information upon the trade and production of the island, from which it is evident, says the *Planters' Gazette*, not merely that European enterprise is extending in various new directions, such as cinchona, cocoa, &c., whilst the exports of sugar and rum last year were larger than for nearly forty years previously, but that the economical condition of the negroes forming the bulk of the population has also greatly improved. The total exports for the past financial year amount in value to over a million-and-half sterling, being an increase of more than £370,000 (we give round figures throughout) on the previous year, and of £205,000 on the average of the five years preceding. On the other hand, the imports have decreased by £70,000, and as this decrease was mainly due to the largely-increased production of ground provisions and other necessaries grown by the native population, it must really be counted as so much gain on the whole to the people—in other words, to the negroes themselves, who form the practical working body of the colony. If they have paid so much the less to outsiders for food, it is because they have raised so much the more themselves for home consumption. When we come to examine the details of the figures, the results are still more striking. The industries peculiarly affected by the free black on his own account show a great general increase. True, last year was a bad one, owing to drought for the coffee crop, the principal stand-by of the industrious hill negroes; and the exports fell to 66,000 cwt. valued at £133,000 as against 87,000 cwt. (£221,000) in the preceding year, and 96,000 cwt. (£310,000) in 1879. This is a serious loss, but the fact that in spite of it the total exports was more than maintained is a very promising one for the future of the colony. At present the industries are becoming more varied, and a loss in one direction may be more than counterbalanced by a gain in another. The most noticeable of all the features in the report is the immense and steady increase in the small negro's business *par excellence*, the fruit trade with America. In 1867 this consisted of a few bunches of bananas and barrels of oranges valued at £725; last year the export of oranges alone had risen to 35 millions, and the value of the trade was £124,000. For a small country like Jamaica, with only half-a-million of inhabitants, this is a very large sum indeed; but what makes it all the more important is the fact that the fruit is almost entirely grown by the small negro peasant proprietor, and that the money thus goes directly into the hands of the people. The total number of holdings of land in the island is fifty-two thousand, of which nearly ten thousand are less than one acre, and twenty-six thousand are between one and three acres; and the proportion of these small holdings under cultivation is far and away greater than the large estates, a vast part of which still remains in wild land. All these facts go to confirm the belief, already held by most of those who know the West Indian negro personally, that the small proprietors are steadily, though slowly, progressing in habits of industry, thrift, and civilization.

THERE is no special mode of making butter (writes Professor Arnold) which is better under all circumstances than every other. What is best for one may not be best for another. The method pursued by an inquiring friend who lowers his milk in deep and narrow vessels into water in his well with a temperature of 50 degs. for thirty-six hours, may be, and probably is, best for him with a small dairy, since he makes an article that brings 4 or 5 cents a pound above other dairy butter in his neighbourhood, but such a practice could not be followed in a large creamery with any convenience or profit; besides, everybody cannot provide himself with such a well. The very finest butter is made by setting shallow in a pure and only moderately cool air; yet this method is now best for general use, because it calls for too much room, too much labour, and too much time and expense, to be acceptable or profitable for those who have much milk to handle. Though the butter might be very choice, it would be too expensive to compete with butter nearly as good, but made with one-quarter the labour and expense, and in half the time. The Elgin creamery buys the milk of 800 to 1,000 cows from large dairies near the city. The best mode in such a case is to set the milk in large vats and cool vigorously with iced water to hurry the separation of the cream, and do it with the least expense; but in new and sparsely-settled localities, it is better to cream the milk at the farm in small vessels with only such refrigeration as the farm affords, and to send only the cream to the factory. Though sudden changes in milk, cream, or butter are not conducive to the highest quality or longest keeping, yet rapid refrigeration, as a rule, brings the best practical results, because it makes a more perfect separation of cream than slow cooling and saves time and expense in working, and thus reduces cost. For those who relish the peculiarly fresh acid taste of a little buttermilk in their butter, unwashed butter will be preferred while it is new. As soon, however, as the buttermilk which adheres to it has had time to change—which it will do in about forty-eight hours in warm weather—its fresh taste disappears, and it begins at first to be stale, then strong, and finally rancid, and decidedly objectionable. If the working is so thorough as to practically remove all of the buttermilk, the increased amount of violence breaks the grain of the butter, and this is about as bad as buttermilk to injure its keeping, so that worked butter is short lived according to the amount of working done to it, or the quantity of buttermilk left in it. Butter which is well washed in good water, especially when it is gathered in pellets or granules instead of in a mass, has no taste of buttermilk, and for this reason those

who prefer that flavour do not admire it so much as unwashed butter. Nine out of ten persons, however, prefer the pure, distinct, and full flavour of butter unadulterated with buttermilk or disguised with excessive salt, and this flavour is obtained only by washing every particle of buttermilk from it, and avoiding the working which must follow when washing is omitted.

A COTTON exposition on a large scale is being organised in the Southern States of America. The committee's prize-list exceeds 5,000 dollars, and it is anticipated that this amount will be largely added to in premiums offered by local dealers. The highest prize offered is 1,000 dollars, for the best bale, long staple (first); and the lowest, 50 dollars, for the best twenty stalks of cotton of the second quality.

MOST farmers have great ideas of creating an improved cow by crossing one breed with another, such as the Jersey with the Ayrshire or Holstein. These violent crosses are opposed to all the principles of breeding, and the great prepotency of the two animals used for the cross are put at war with one another. This creates the greatest uncertainty as to results, and there is sure to be a want of uniformity in the offspring. It is better to grade than to cross, that is, use a thoroughbred bull of your favorite breed on a native cow. This native will be found to respond kindly to this treatment, and the offspring will follow strongly the prepotency of the bull.—*American Dairyman.*

SOME comparatively recent investigations of Professor Forbes, the State Entomologist of Illinois, and published in the "Science" column of the New York *Independent*, are exceedingly instructive. He selected an orchard which for six years had been stripped by the canker worms. He shot a considerable number of birds therein for two successive years, on May 24, 1881, and May 20, 1882, representing nearly all the kinds seen in the orchards, made full notes of the relative abundance of the species, examined carefully the contents of all the stomachs obtained, and tabulated the results. It appeared that the robin and six other species of the family had eaten no vegetable food, 96 per cent consisting of insects, of which 16 per cent was canker worms and only 4 per cent insectivorous beetles. The blue-bird ate 12 per cent of canker worms; the house-wren 20 per cent; fourteen warblers ate 75 per cent of canker worms; thirty cedar wax-wings destroyed 2,000 canker worms a day or 90,000 for the month during which the worm is exposed; and forty-seven finches, or seed and grain eaters, ate 98 per cent of insects, of which 40 per cent was canker worms. From these observations the author concludes that birds of the most varied character and and habits, migrate and resident, of all sizes, from the tiny wren to the blue-jay, birds of the forest, garden and meadow, those of arboreal and those of terrestrial habit, were either attracted or detained here by the bountiful supply of insect food, and were feeding freely upon the species most abundant. That 35 per cent of the food of all the birds congregated in this orchard should have consisted of a single species of insect is a fact so extraordinary that its meaning cannot be mistaken. Whatever power the birds of this vicinity possessed, as checks upon destructive irruptions of insect life, was being largely exerted here to restore the broken balance of organic nature.

THE fundamental principles of reproduction [N. Y. Agricultural Experiment Station, Geneva, N. Y., July 7, 1883] seem alike in the animal and vegetable kingdom. In both, the mystery of life; in both, accretion through cell multiplication; in both, changes of form as arising from immediate heredity and as governed by environment. In our domesticated plants as in our domesticated animals, we have the male and the female element of varying potency whose union is productive of the new individual. Both classes are alike influenced by the conditions described under the term selection. We can, hence, speak of breeding the plant as legitimately as we can speak of breeding the animal. We may also use the term, pedigree, as applied to the improved forms of animals. As in our domesticated animals, improvement is brought about through the systematic mating and selection which constitute pedigree, so the same system in our domesticated plants will avail to produce an improvement which may be described in the same terms. If a pedigreed animal is superior in value on account of the conditions which allow this term to apply, then a pedigreed plant must necessarily possess superior value over the plant which has been developed only through unsystematic effort. As the recognition of the value of systematic effort in improvement has differentiated the pursuit of animal breeding, and has constituted a class of men called breeders, so seed-growers should be likewise differentiated into a class called seed-breeders. Seed-breeding is already beginning to be, and soon must become, of importance as a farm or garden pursuit.

In gardening we have many illustrations of seed-breeding in the production of new forms of vegetables, secured through hybridization and careful selection, as also in the system called "rogueing," which consists in the removal from plants designed for seed purposes of all the plants which are untrue to the form desired. In agriculture we have fewer illustrations, and the farmer has applied less discrimination to his field produce than the gardener has to his small but more intensely cultivated garden. We have, however, a few illustrations in agriculture of what may be accomplished through the selection of seed under that uniformity of idea which is described as seed-breeding. In 1857, Major Hallet, of Brighton, England, commenced his experiments on wheat, selecting his seed from the quality of the plant produced, his standard embracing hardiness, trueness to type, quality of sample, productiveness, power of tillering, stiffness and toughness of straw and earliness of ripening. The results obtained may be expressed in the following table :

Grains in original ear.	Kind of Wheat.	Grains in improved ear.
45	Original red, commenced in 1857 ..	123
60	Hunter's White, ,, ,, 1861...	124
60	Victoria White, ,, ,, 1862...	114
32	Golden Drop, ,, ,, 1864...	96

We have here an illustration of what has been obtained in the effort to increase the prolificacy of the plant, and this gain in prolificacy has also been attended by a gain in the size of the kernels. The amount of crop raised, or prolificacy of the plant under circumstances of field seeding also, if reports are to be trusted, offer parallel results; the increase of yield by the use of Hallet's seed in various countries in the world being reported as between two and three times the average crop from other varieties.

In the case of the Waushakum corn, the selection being made by castrating the barren stalks for two years in succession, the seed saved being not from the most prolific stalks that were left, but merely of the perfect ears, raised the average crop from about 45 bushels to 80 bushels to the acre.

Although the Station has not as yet had time to do much work in this direction, yet a beginning has been already made. On account of the importance of these facts relating to seed, we are disposed to quote the conclusions gained by Major Hallet, which read as follows :

1. Every fully developed plant of a cereal presents an ear superior in productive power to any of the rest on that plant.
2. Every such plant contains one grain which, upon trial, proves more productive than any other.
3. The best grain on a given plant is found in the best ear.
4. The superior vigor of this grain is transmissible, in different degrees, to its progeny.
5. By repeated careful selections the superiority is accumulated.
6. The improvement, which is at first rapid, gradually after a long series of years is diminished in amount, and eventually so far arrested that practically a limit to improvement in the desired quality is reached.
7. By still continuing to select, the improvement is maintained, and practically a fixed type is the result.

An account of Major Hallet's process may be found in *Popular Science Monthly* for July 1882.

So far as the Station work has gone, these claims of Major Hallet have received confirmation. It is particularly noticeabl

able that when each kernel of the ear of wheat is planted by itself, one kernel has invariably proved far more productive than any other one, not *per gradum*, but *per saltum*, *i. e.*, not regularly, but at a jump.—E. Lewis Sturtevant, Director.

I planted a peach orchard, writes M. Siroy, of the Society of Horticulture, and the trees grew well and strongly. They had just commenced to bud when they were invaded by the curculio (*pulyon*), which insects were followed, as frequently happens, by ants. Having cut some tomatoes, the idea occurred that by placing some of the leaves around the trunks and branches of the peach trees, I might preserve them from the rays of the sun, which are very powerful. My surprise was great upon the following day to find my trees entirely free from their enemies, not one remaining, except here and there where a curled leaf prevented the tomato from exercising its influence. These leaves I carefully unrolled, placing upon them fresh ones from the tomato vine, with the result of banishing, the last insect and enabling the trees to grow with luxuriance. Wishing to carry still further my experiment, I steeped in water some leaves of the tomato, and sprinkled with this infusion other plants, roses and oranges. In two days these were also free from the innumerable insects which covered them, and I felt sure that had I used the same means with my melon patch I should have met with the same result. I therefore deem it a duty I owe to the Society of Horticulture to make known this singular and useful property of the tomato leaves, which I discovered by the merest accident.

Although, says a contemporary, the teak forests of Upper Burmah are a source of wealth which for another generation at least will always bring in a handsome revenue, even if worked in the wasteful and extravagant manner which characterises most of the financial experiments of that country, they must come to an end in time, for no steps are taken in Upper Burmah to reproduce them. The mineral resources of Upper Burmah are known to be great, but these also are sadly neglected. The rich soil and the excellent climate should make agriculture what it has never yet been, the real source of the wealth of both people and Government. Wheat of an excellent description grows near Sagine, and two crops a year can be had with very little trouble. But few people care to cultivate anything beyond small patches yielding them from 20 to 30 baskets. If any one tried agriculture on an extended scale, he would at once be a marked man, and officials from the highest to the lowest would look upon him as a fit object for squeezing. Under such a rule it is hardly surprising that a soil which seems to "blossom at a touch" is often altogether neglected, and that people, who do not know if they will be allowed to reap, show a supreme indifference to the preliminary operations of ploughing and sowing. The Burman plough used in our own rice-fields is not a very scientific instrument, but it goes very much deeper into the soil than the one used in Upper Burmah, and yet even with their primitive implements wheat grows to profusion wherever it is planted. Upper Burmah might not only supply all our needs in this article, and render us independent of Indian supplies, but might export that grain to Europe, where a constant and remunerative market would always be met with. It is to be regretted that the more enlightened of the Burmese ministers do not awake to the advantages to be derived from extending wheat cultivation in their country, and imbuing agriculturists with the required faith in the stability and honesty of the present rule, which would result in improving the prosperity of the people and of the whole country.

The following resolution appears in the *Gazette of India* :—

"A frequent objection to the salt-tax in this country is that it makes salt so dear that the people cannot afford to give it to cattle in quantities sufficient for the health of their stock. In several European countries where salt is subject to a heavy duty, means have been found for supplying owners of stock with cheap salt for the use of their cattle and sheep Without attempting to prejudge the case in any way, and without committing the Government beforehand to any pledges which it may be found impossible or inexpedient to fulfil, it may be admitted that in India, where the bulk of the population is dependent on agriculture, it would be a distinct gain to be able to issue cheap salt for cattle, and the question of meeting this necessity in a way compatible with the safety of the salt revenue has more than once engaged the attention of the Government of India. On the last occasion on which the question was taken into consideration, it was suggested that the object aimed at would be secured if a process could be discovered by which salt could be rendered so unfit for human consumption that its restoration to an edible condition would be neither easy nor cheap, while it would still remain suitable for use by cattle. This suggestion commended itself to the Government of India, for, if this could be done, salt could safely be issued for stock at a comparatively cheap rate without coming into competition with salt intended for human consumption. Experiments for denaturalising salt were accordingly undertaken in Bengal and the Punjab, details of the processes used in Germany and France having been obtained through the Secretary of State. The experiments were a failure, in so far that they did not satisfy the main condition that the restoration of the medicated salt could not be cheaply and easily effected, while the German and other process were found either unsuitable or otherwise objectionable in this country. The problem of issuing salt for cattle in a form which will not endanger the public revenue, therefore, still remains unsolved. The Governor-General in Council has again had the question under his consideration, in connection with a process devised by a private individual, and submitted for trial to the Commissioner of Northern India Salt Revenue. This process, like those previously tested by Government officers, has not given satisfactory results in practice. But his Excellency in Council is inclined to think, on perusal of the papers read in the preamble, that the experiments as yet made have not been as wide or exhaustive as the importance of the subject demands. If any satisfactory method could be devised which fully met the requirements of the case, a great boon would be conferred on the country, and it is hoped that a process may yet be discovered which, if not satisfying all the conditions hitherto prescribed, may yet be sufficient for all practical purposes. His Excellency in Council accordingly requests that the Local Governments will be good enough to arrange with their chemical analysers, or with any other thoroughly skilled and competent officer, for the commencement of systematic and careful experiments in the direction indicated. The officer selected should be furnished with a complete copy of the papers containing the details and results of all the attempts already made, and the results of the experiments made under these instructions should be communicated to the Government of India. If any private person should wish to take up the enquiry, the Government will be glad to furnish him, on application, with copies of the correspondence read in the preamble to this Resolution."

The discovery of "Kairin," a quality latent in coal tar, which resembles that of quinine, says the *Madras Mail*, is likely to prove a blessing to a mankind, should further experience confirm the result attained by careful experiments up to the present time. It had been known for some time past that the plants brought to India by Mr. Clements Markham belonged to an inferior species of cinchona, and are comparatively valueless. Useful alkaloids, no doubt, can be extracted from them, tinged, as it were, by a small amount of the virtues of true quinine, and it is possible that a febrifuge may be obtained sufficiently powerful to act upon the easily affected constitutions of the native population. But Europeans require a more potent principle to counteract the fury of fever. This febrifuge, which General Richard Strachey has taken under his especial patronage, is the utmost that science can extract from the immense plantations at Darjeeling. The Nilghiri trees must be classed under a different category. For the most part they are grown from Dutch seed, and are descended from the legitimate quinine-producing cinchona of South America. It is stated, however, that the process of extraction demands the utmost nicety of manipulation, and that native assistants have failed to give satisfaction even in the preparation of the milder febrifuge.

They could not be trusted to work by themselves, but had to be closely superintended through every stage of the operation. There is some talk, we believe, of making one more vigorous attempt to establish in Calcutta a thoroughly organized laboratory for the manufacture of febrifuge, abandoning all ambitious hopes of supplying the European garrison with Indian quinine as well as with Indian beer. The project of introducing the cinchona cultivation into Guatemala will create a formidable though beneficial rivalry. So long as quinine is obtainable at a price that will render its application universal, we must not look too closely to the quarter whence relief comes to the sick and suffering, though we may be pardoned a regret that such an unfortunate blunder was committed by Mr. Markham. At the same time, it appears to us a very short-sighted economy to maintain the Darjeeling plantations at a great cost for such little purpose, when, by the courageous expenditure of a certain sum of money, the true cinchona might be brought in to supplant its bastard brother. The real objection, we fancy, may be traced to a natural, if weak-minded, reluctance to acknowledge an error of judgment. Instead, however, of wasting time and money on the production of an inefficacious febrifuge, it would be far wiser to get rid of the Darjeeling plantations altogether, and to begin afresh with good Dutch seed, and with young plants from the Nilgiris. The Agricultural Department must have been nodding not to have taken up this matter heartily, and pressed it upon the earnest attention of the Government. The introduction of the true cinchona would be a far more valuable boon to "the bulk of the people" than the abolition of anomalies and the worship of the abstract."

The following letter of Surgeon-General Balfour to the Under-Secretary of State for India has been communicated by the writer to the *Journal of the Society of Arts* :--

Sir,—During the bygone nine years, the quantities of poppy seeds exported from India have been on the increase, giving an outlet to a product which was formerly only locally used, and employing a considerable amount of tonnage.

I beg to place on the margin the countries to which it was shipped in the year 1881-2, and it would be of value to India, and to the mercantile and manufacturing communities of Europe, if information could be obtained as to the purposes for which, in France and the United Kingdom, such large quantities are utilised. In all probability it is pressed for the oil, which may be used as a substitute for olive oil.

It has been a subject of inquiry by Deputy-Surgeon-General Day, with myself, as to what oils are used for the sardines of the Mediterranean, in order that he might be able to recommend the same for the pilchard trade.—I have the honour to be, Sir, your obedient servant,

EDWARD BALFOUR.

Year.	Cwt.	Value in Rs.
1874-5	402,296	22,12,58
1875-6	253,326	13,54,194
1876-7	351,133	18,43,647
1877-8	449,304	26,45,257
1878-9	249,072	16,60,749
1879-80	530,382	37,51,347
1880-1	579,544	39,76,254
1881-2	603,280	39,64,065
1882-3	571,542	30,26,401

Country.	Cwt.	Value in Rs.
France	346,031	22,50,871
United Kingdom	170,493	11,04,984
Belgium	74,582	4,71,239
Egypt	9,111	57,634
Holland	1,809	11,080
Germany...	1,000	6,230
Other Countries	203	1,417

Sir Louis Mallet, in his answer to Surgeon-General Balfour, enclosed a letter from the Board of Trade, signed by Mr. Giffen, containing the following particulars :—"The seeds in question are classified in the Import List amongst the unnumerated seeds from which oil is expressed, and the Board of Trade have no information as to the uses to which they are applied. It appears, however, from a communication which has been received from Mr. Dyer, the Assistant Director of the Royal Botanical Gardens at Kew, that these seeds yield about 50 per cent of a very valuable oil, which is easily decolorised, dries well, and remains fluid to a low temperature, and it is understood that this oil has long been recommended as a substitute for olive oil."

A WRITER in the *Scientific American* states that, within 500 miles of New York city, there is a large section of country, comprising from 12,000 to 14,000 square miles, which, for the quality and variety of its minerals, is in all probability the richest and most interesting mineral country in the world, and one not surpassed by Saxony, in Europe. This remarkable section lies on the borders of Kentucky, Tennessee, North Carolina, and West Virginia. Seventeen counties of Virginia are included in it, and to these may be added Ashe, Alleghany, and Wantanga counties in North Carolina, which form an intergral part of the same geological formation, and contain the same kind of minerals. In this section are to be found gold, silver, copper, lead, zinc, nickel, iron, manganese, plumbago, arsenic, antimony, limestone, gypsum, salt, barytes, kaolin, feldspar, soapstone, fireclay, asbestos, talc, mica, umber, millstone grit, marble, sandstone, granite, syenite, and many of the minor minerals useful in arts and manufactures. Besides this, the country is finely timbered, from the valleys to the mountain tops, with white oak, walnut, maple, tulip-tree, bats-wood, hickory, cherry, chestnut, buckeye, cucumber-tree, and other oaks, dogwood, white pine, black pine, spruce cedar, and many other useful and valuable woods. It is also a fine agricultural district.

THE great and growing increase in the consumption of paper, and the corresponding scarcity of rags, naturally cause attention to be turned to substances suitable for the paper manufacturer. Already the alfa and the ramie have been pressed into his service ; and the same country which produces these, *viz.*, Algeria, also affords another plant which, while being useful for this purpose, is, at the same time, a great enemy to the agriculturist. This is the dwarf palm, the fibrous properties of which have long been known to the Arabs, while they have been unable to turn them to account. A Frenchman, M. Reynaud, has found means for utilising the whole plant, except the roots, which serve for firing. Every part, from the stalk to the top-most leaves, is transformed into fibre of excellent quality, and it makes no difference if the plants have been pulled up several years previously. The plants are placed in a kind of cage, which is immersed in a boiler filled with a special lye, and heated. The substance being thus retted, becomes soft, so that the fibre may be readily separated. It is withdrawn from the bath, and drained, the lye being saved for use over again. It is then passed between rollers, while at the same time being made cold by quantities of water. The number of rollings, rinsings, and combings depend upon the degree of fineness required. At last, the product is allowed to fall into a receptacle containing pure water, whence it is withdrawn to be tied up in bundles for transport. The vegetable hair which may also be obtained from this plant is finer and more tenacious than any other known ; it readily takes all the ordinary dyes, even without being bleached. As the whole of the tannin which it contains is not extracted, this plant is not liable to decay, while it is, at the same time, antiseptic, on account of its aromatic odour, and to some extent impermeable by water.

THE process of turning straw into paper from the raw material to rolls and sheets is an interesting one. Beginning in the upper part, the rye and oat straw hoisted by a fork, after being cut, is carried into a large cylinder. In this, the cut straw is cooked by steam, and mixed with chemicals, which are drawn from large tanks. From the digester the

cooked straw is taken to the bleaching machines, where the cooked mass is reduced to fine pulp, and from these it is taken to the beating engines to draw out the fibre, so that the stock will "web." After this process it is emptied into stuff chests and kept stirred by an "agitator. The pulp now for printing paper looks like milk and water, and for wrapping paper like thick mud, and of whatever colour desired; and it is ready for the paper-making machine." A floating cylinder in each tank takes up the pulp, conveys it on a felt carrier, where it passes through rollers weighing a thousand pounds, which presses out the water. It is now a sheet, and passes round eight drying cylinders four feet long and three feet in diameter, heated by steam. Next it goes through two sets of heavy thousand-pound rollers, and afterwards round a set of seven solid chilled rollers a foot in diameter. The paper is finished and passes to the cutter, where it is cut into sheets and packed in bales. By a new process it is expected to utilize flax straw, which has hitherto gone to waste.

TABLE napkins are regularly supplied at the cheap dining-rooms of Berlin. The napkins are of tissue paper, with a coloured ornamental border—not only because paper is cheaper than diaper, but as a protection against pilfering. Indeed so common are paper table napkins at Berlin that the manufacturers advertise them regularly in all the newspapers at 9s. per thousand, being about nine or ten a penny.

A NEW kind of matting or carpet for covering floors, says a contemporary, is composed of a fabric woven or knit from strands or threads of paper in such a manner that when, laid upon a floor, it will serve all the purposes of ordinary straw matting or textile carpets, and can be cleansed by washing when such becomes necessary or desirable.

Any kind of strong paper is taken and cut or formed into strips of the required or suitable size, and then twisted or spun into strands or threads. If a fine texture is desired, the strips are made smaller than where a coarse texture is preferred; but in either event the twisted or spun strands or threads are woven or knit into a fabric by any of the well-known methods practised in weaving or knitting textile material. Before or after the paper strands or threads are woven or knit into the matting or carpet, the paper may be rendered waterproof by saturation or impregnation with any known waterproofing material; or it may be otherwise chemically treated in order to strengthen it, and permit the use of water or other cleansing fluid in washing the floor covering when desired to free it from dirt or stains, and it may also be treated with carbolic acid or other material to prevent the ravages of insects.

If the strips of paper are properly and tightly twisted or spun into strands or threads and closely woven or knit, the fabric can be subjected to a moderate amount of washing without liability to injury. The strips of paper may be formed very narrow and spun or twisted with strands of yarn: or the twisted paper strands may be woven or knit with some suitable animal or vegetable matter, the strips of twisted paper forming the warp or the woof, and the animal or vegetable matter forming the warp or the woof, as desired.

Paper strands or threads produced from differently-coloured paper, produce a variety of designs in the fabric during the process of weaving or knitting, as well as the various designs that are produced in ordinary tapestry; and the fabric can be woven or knit into any determined dimensions to be fitted to the floor of an apartment, so that the floor covering will be in a single piece.

Paper produced from what is known as the "palmetto-leaf" is preferred for this use as it is strong and durable; but it is obvious that paper produced from other substances can be used.

THERE is now every prospect, it seems, of excellent crops throughout the Canadian North-West. In Ontario the hay crop is the largest for the past twenty years, and the hay is now selling in Ottawa Valley for £1 12s. per ton. The grain crops in Ontario are not so abundant, but there is every probability that better prices will be paid than last year.

AT the Royal Show at York, a new method was shown of utilising skim milk. Mr. Ahlborn, of Hildesheim, Germany, at his model dairy made what he calls "sparkling milk," and which is neither less nor more than soda milk or ærated milk. It is skim milk impregnated with carbonic acid gas, in exactly the same manner as water in the manufacture of soda-water, and is forced into similar bottles, corked and wired down, and is then ready for sale. It will keep an indefinite period; one bottle was opened that had been made 17 weeks previously, and which was quite fresh and good, and as frisky as possible. It is a very takeable beverage, and was quite as refreshing to a thirsty soul as soda-water, with the additional advantage of being distinctly nutritious. The cost of making it is very small, and it could easily be sold as cheaply as soda-water. The price of the machine for making it is £40—possibly smaller sizes might be got—and the same machine will make ærated drinks of any kind.

WE are all taught (says the *North British Agriculturist*) that by reason of the inclination of the earth's axis, the several seasons happen at different times in different portions of our globe, so that seed-times and harvests do not correspond in the various zones. But probably few persons realize that if all the harvest periods of the world were grouped together, they would be found to occupy altogether more than three-fourths of the whole year. As a fact, leaving out of sight altogether the equatorial and neighbouring regions, in which different seasons are actually contemporaneous, there are perhaps only two months out of the twelve in which the harvest is not being actually gathered somewhere on the face of the earth. Thus, in the greater part of Chili, portions of the Argentine Republic, Australia, and New Zealand, January is the harvest month. It begins in February in the East Indies, going on into March as we come North. Mexico, Egypt, Persia, and Syria reap in April; while Japan, China, Northern Asia Minor, Tunis, Algiers, and Morocco, and also Texas, do so in May. California, Spain, Portugal, Italy, Sicily, Greece, and some of the southern departments of France, gather the harvest in June. July is the harvest month for the greater part of France, for Austria, South Russia, and the greater part of the United States of America; Germany reaps in August with England, Belgium, the Netherlands, part of Russia, Denmark, part of Canada, and the North-Eastern States of America; September is the time for Scotland, the greater part of Canada, Sweden, Norway, and the Northern Midlands of Russia: while the harvest drags on slowly throughout October in the most northern parts of Russia and the Scandinavian Peninsula. It would thus seem that November and December are the only months which have not a place in the harvest calendar of the world.

THE frequency of thunderstorms in Switzerland this summer has afforded Professor Colladon, of Geneva, a great authority on electricity and meteorology, ample opportunity of continuing his observations on the effect of lightning on trees and vegetation generally. He has ascertained that when lightning strikes a tree it leaves very few marks of its passage on the upper part and middle of the trunk—a peculiarity which he ascribes to the fact of those parts being more impregnated with sugar, a good conductor, than the lower part. As the electric fluid descends to the neighbourhood of the heavier branches, where there is less saccharine matter, it tears open the bark, and in many instances shivers the tree. It is no uncommon thing to find the lower part of a tree literally cut by the lightning, while the upper portion and the higher branches seem to have suffered hardly at all. Oaks, however, would appear to present an exception to this rule, for they are often found with tops quite blasted, and the passage of the lightning lower down marked by a gouge-like furrow. These furrows sometimes go completely round the tree like a screw, the reason of which, says Professor Colladon, is that the lightning follows the cells of which the bark is composed lengthwise, and in certain sorts of wood these cells are disposed spirally.

THE recent rain in the Punjab has been most seasonable: about half the *kharif* has been saved, and there is every

ground for anticipating a good *rabi*. Four months ago, in Hoshiarpore, *sur* was selling at 16 seers per rupee; it is now barely 8 seers; and wheat, which was selling at 32 seers, has gone down to 20 seers per rupee.

The drought in Upper India has been very severe and prolonged. In Hoshiarpore the rainfall from 1st April 1882 to 31st March 1883 was 14 inches under the average, the result being that a great many wells and tanks had run dry, and in many parts of the district the people were obliged, previous to the last rainfall, to send their cattle 30 and 40 miles off down to the Beas and Sutlej Valley for grazing and water, the low hills and submontane tracts being quite bare, tanks dry, and no green grass left.

In a little work, published at a shilling by Cassell & Co., "An Old Exhibitor" gives his experience in potato culture. With the view of stopping the ravages of the disease, he recommends early planting and early lifting; the proper selection of healthy sorts; and the substitution of manures with suitable chemical ingredients for gross farmyard manure. The disease, he agrees, is due to atmospheric influences, and is supported by dampness and shade, the former of which can be counteracted by drainage and keeping the soil in a loose, dry state, and the latter by thinning out the stems and foliage as they become too thick, and so exposing the surface of the ground to light and air. A common source of disease is the fermentation that takes place in heaps of green tops, and which causes the malaria to spread in all directions; the shaws should therefore be carried away at once and buried. At planting time, too, the unused potato sets should not be left in a heap on the field, because they quickly ferment and throw off a gas which carries with it the germs of the disease. The author is strongly opposed to the notion that potatoes should have a long period for ripening in the ground after the crop is completed, believing that nothing tends so much to produce disease. As soon as the tubers are fully grown, he recommends that they should be lifted and stored, any delay having only the effect of increasing the risk of disease. For keeping potatoes any length of time he finds the handiest and safest plan is to store in heaps on the ground, every precaution being taken to guard against the four enemies of the tubers—frost, wet, disease, and light.

The writer also advises those entering on experiments to raise their own seed and grow their own sorts, in preference to grafting one stem on another or grafting eyes. He believes the latter method will fail to produce distinct varieties. A light fibrous loam is the most suitable soil for the potato, and thorough cultivation is necessary to its successful growth. He considers horse-dung the best manure for cold, wet soils, and cow-dung for hot, light soils, with a top-dressing of guano, potash manures, soot and salt or bone manures. He does not favour Mr. Jensen's theory of earthing-up. A sharp ridge, in his opinion, causes the crop to suffer from drought, the rain being carried away from the roots of the plants; a hollow along the top of the ridge would cause an excess of moisture; but an inch or two of earth placed around the stems would strike the happy medium, and yield dry, clean tubers in the greatest quantity, and of the best quality. In preparing sets, due regard should be paid to the position of the eye on the tuber, as the shape of the tuber depends very much upon that. He agrees with the opinion that there are a separate set of fine tissues or vein-like threads for each eye, and experiments have shown him that in cutting potatoes for sets, sufficient width and depth of flesh must be left around the eye that is intended to produce the crop. They also proved to his satisfaction that when the cut is made too near the eye, or when the portion left is very thin, the eye is weakened by the fibres being interfered with. "An Old Exhibitor" argues that the potato is about the most profitable thing that can be brought into the market, and that the French and Belgian competition can be met by earlier and thicker planting, if the drills were only a foot apart, the sets eight inches apart, and the seed so sorted that each set is only allowed to make one sprout. If planted in the second week of March, they should be full grown by the first week of June, when potatoes are selling at about 2*s*. per stone; and a medium crop from his method of planting would be 4,840 stones per acre which would yield £484, a very handsome return for the outlay.

The writer concludes his little *brochure* by giving a descriptive list of known varieties of potatoes suitable for cropping, indicating those which are likely to prove most satisfactory.

It appears from statistics that there are in the world no less than 3,985 paper mills, producing yearly 959,000 tons of paper made from all kinds of substances, including rags, straw, and alfa. About one-half the quantity is printed upon; and of these 476,000 tons, about 300,000 tons are used by newspapers. The various Governments consume in official business, 100,000 tons; schools, 90,000 tons; commerce, 120,000 tons; industry, 90,000 tons: and private correspondence another 90,000 tons. The paper trade employs 192,000 hands, including women and children.

The following is a letter from Deputy Surgeon-General M. C. Furnell, M.D., Sanitary Commissioner for Madras, to the Chief Secretary to Government:—

I have the honor, with reference to the Order of Government of 11th July 1883, No. 841, Revenue, on an inquiry to be made regarding a disease said to be prevalent amongst sea-fish, to report that I find certain steps have already been taken by this department, before the above order was received, which it would be as well Government should be informed of.

During my absence on privilege leave a letter was addressed to Dr. Bidie, Acting Sanitary Commissioner, from the French Vice-Consul of Madras, enclosing another from the Government of Pondicherry, in which latter it was stated that the sanitary authorities of that town had, on examination, discovered worms in certain sea-fish, "qui en rendent l'indigestion dangereuse pour la santé," and asking if the like phenomena had been observed in our territories.

In reply, Dr. Bidie remarked that no official information had reached this office regarding sale of diseased fish in Madras, but that the rumour prevalent in Pondicherry on this head had made its way to this town, and that many persons in consequence refrained from, as usual, using fish as food. In the meanwhile he would be glad to be furnished, from the French authorities, with more detailed information as to which species of fish had been found unwholesome, and what sickness had arisen therefrom. To this letter, dated 9th June 1883, no answer has as yet been received.

About the same time the President of the Municipal Commission, Madras, and the Commissioner of Police, Madras, were addressed for any information they might possess on the subject, and the Museum assistants were instructed to make careful dissections of fishes, and preserve any parasites that might be discovered therein.

The answer of the President of the Municipal Commission, copy of which is attached, was to the effect that a belief was prevalent in Madras that many species of sea-fish were diseased, and that the consumption had decreased and prices fallen, but that at the time of writing (June 20th) the scare was passing away and trade resuming its normal condition. He enclosed a list of fish in which parasites had been found, but ends his letter with the following remark:—"I have heard of no case of sickness or disease from eating fish."

The Commissioner of Police was not able himself to send any information of a useful nature, but enclosed the reports of four Inspectors of divisions. Two of these speak of there being a rumour, but that in their divisions it had not deterred the people from using fish as usual. In Triplicane the people have been alarmed, but the Inspector had not heard of any ill-effects having arisen. The scare at the time of his report (June 15) was subsiding. The fishermen blamed the mutton butchers for the whole story, as a diminished consumption of fish, of course, increased their trade. In Mylapore, according to the Inspector's report, the scare seemed to have existed with greater force than elsewhere, and the people there labored under the belief that people using diseased fish would suffer from leprosy. A fish formerly sold for four annas fetched no more than six to nine pies.

Dr. Bidie informs me that the assistants of the Museum examined 122 fish, embracing twelve species of the kinds most commonly sold in the bazaars. Of the total inspected, 40 only,

comprising nine species, were found to contain parasites in the æsophagus, stomach, or intestines, but in no case was the flesh found to have an unhealthy appearance.

Since the receipt of the order (11th July 1883, No. 841, Revenue,) I have personally inspected the various fish markets, and find from inquiry that the trade has resumed its normal state, the scare having subsided. I have also examined a great many fish, and found parasites in only a very few: a more detailed account of these examinations will follow. My object at present is to inform Government of what has been done, and that the panic—if such it can be called—has apparently entirely subsided.

In a letter to Sir Louis Mallet, Mr. W. T. Thiselton Dyer, Royal Gardens, Kew, says:—I am desired by Sir Joseph Hooker to draw your attention to the steps which have been taken by this establishment to obtain information as to the lacquer industry of Japan. As you are aware, its products are highly esteemed by all lovers of art, but up till the present time practically nothing has been known as to the methods by which such beautiful objects are obtained.

From the statement of Kämpfer (1712), it has been accepted by botanists that the varnish, which is the basis of all lacquer work, was obtained from incisions in the three-year old stems of a tree indigenous to Japan, known as *Rhus vernicifera*. Beyond the fact that the tree is cultivated as coppice-wood, the information of Kämpfer does not go, and up to the present time our knowledge of the subject has been a complete blank. Thus Balfour in his Cyclopædia of India (1873) states that "the manner of preparing it (the varnish) and the mode of applying it, is and is likely to remain a secret." It had been supposed that the Japanese lacquer tree was identical with a common Himalayan species of *Rhus*. Dr. Brandis points out, however, (Forest Flora, page 121) that the Himalayan tree is not "known to yield any varnish;" and Sir Joseph Hooker in elaborating the *Anacardiaceæ* for the Flora of British India (ii, page 11) has, in describing it under the name of *Rhus Wallichii*, decided that it is not identical with the Japanese species. The lacques varnish tree of that country is apparently unknown in India. It seems worth while, therefore, to draw the attention of the Government of India to the fact, as seed could doubtless be easily obtained from Japan, and there are many parts of India in which the tree could be cultivated.

In its lac industry India possesses an art which is closely allied to that of lacquering. It can scarcely be doubted that the latter is equally adapted to the methods and habits of the natives. Its results are, in an economic point of view, infinitely superior to those in which lac is used.

At the instance of Sir Joseph Hooker, the Foreign Office caused an elaborate inquiry to be made by its officers in Japan into the whole subject. The result will be found in a report by the Acting Consul at Hakodate, dated Tokio, January 13, 1882, which has been printed and laid before Parliament. I am now to suggest that copies of this report, together with this communication, should be printed and transmitted to the Government of India, in order that some attention should be attracted to the subject in that country.

The very complete collection illustrating the report has been transmitted to Kew and exhibited in the Museum of Economic Botany. It has been pronounced by experts in Japanese art to be of exceptional interest and quite unique of its kind. A portion of the expense incurred by the Foreign Office in getting it together has been defrayed from the grant made to this establishment by the India Office for the sustentation of the economico-botanical collections relating to India.

I am desired by Sir J. D. Hooker to inform you that he received from Mr. Quin, Acting Consul at Hakodate, a small quantity of seed of the Japanese lacquer tree, *Rhus vernicifera*. Portions have been transmitted to Saharunpore and Madras for experimental cultivation. Mr. Quin states that these particular seeds were obtained "from trees which undergo a very severe winter, being almost buried in snow for several months." The tree, however, will doubtless do equally well in a less rigorous climate. Mr. Quin further states that the wax used in the north of Japan is all made from the berries of *Rhus vernicifera*.

Mr. J. Mills, in a letter to the Madras Board of Revenue, has the following remarks regarding the dietetic uses of salt:—It would be a difficult matter to say exactly what diseases originate from a want of proper supply of chloride of sodium, as it has never been recorded, so far as I know, that any of the herbivora have absolutely been deprived of it, for the reason that it is always more or less present in their natural diet; at the same time, animals do suffer very much in a general way from the want of a sufficient supply of salt. This is to be accounted for by the fact that the blood, to be pure and wholesome, must contain a due proportion of chloride of sodium; there must, as it were, be a porper balance of its constituents, and if this is not maintained, we have a fluid circulating throughout the body which is unable to replace, to repair, to build up, or to compensate for the waste of tissue which is constantly going on in the animal economy, and the result is mal-nutrition and general ill-health. This has been frequently demonstrated, and an animal in this state is always more prone to attacks of disease of every description; but no hard-and-fast line can be laid down as to the exact nature of disease which might develop itself. Therefore, I confine myself to a brief description of the advantages of the use, and the bad effects of a want, of a proper supply of salt.

Uses of Salt as a Dietetic.—The constant presence in the secretions of salt, and necessity of it in due proportion in the blood, indicate the importance of a proper supply of it with the food. We perceive this in the instinct of animals; when it does not exist in sufficient quantity in their food, they will travel long distances and brave the greatest dangers to obtain it.

2. It is considered to be the natural stimulant of the digestive system, and to assist the blood in maintaining its fluidity, its stimulating properties, and its powers of self-preservation.

3. It gives flavor to and renders food more palatable; even fodder of inferior quality is readily eaten when properly salted. The preferable way of salting hay would be to sprinkle it over the different layers as the stack is being made up, which will correct the bad effects of damp and smut.

4. It is especially necessary to animals receiving cooked grains or roots, for the salt naturally present in such prepared food is usually in small amount.

5. By causing thirst, it induces cattle to drink large quantities of water, which in torpidity of the bowels and constipation (disorders which are extremely common among Indian cattle during the dry season of the year, when the herbage has little or no succulent properties) is most essential, as it softens and carries onwards through the stomach and intestines the hard and dry ingesta and fœces, thus warding off *impaction*, which is a most troublesome and often fatal disease.

6. With catttle, sheep and goats, salt can be employed in the capacity of a purgative with great benefit, and is second only to Epsom salts (sulphate of magnesia), and can be used to empty the bowels in distention of the rumen with food or gas (tympanitis) in impaction or diarrhœa, depending on over-feeding or kept up by the presence of irritating matter in the digestive canal. In fact it may be given with the utmost safety as a purgative in all diseases where it is found desirable or necessary to open the bowels.

7. Small and repeated doses have an alterative effect, and are useful in all animals in indigestion and irregularity of appetite.

8. From its action as a stimulant as well as the cold it produces during solution, it is of great benefit in various diseases of the joints and feet, particularly among cattle, sheep and goats.

9. Salt has the power of increasing the fertility of the male and the fecundity of the female, and it doubles the power of nourishing the fœtus.

10 During the period the young are strucking, salt given to the mother renders the milk more abundant and more nutritious, and accelerates the growth of her offspring.

11. If regularly given, it lessens the liability to intestinal worms, and an injection of half-an-ounce of salt with a pint of water will often bring them away from the large bowel.

12. The body of an animal getting a regular supply of it becomes an unsuitable habitat for the parasite world in general; consequently, it is a highly valuable agent as a preventive against the attacks of these pests.

13. For preventing and arresting putrefaction, salt is cheap and effectual, and stands on the list of antiseptics next after carbolic acid. For antiseptic purposes it is advantageously conjoined with carbolic acid. To disinfect skins and other animal substances a pound of salt and two ounces of carbolic acid are used dissolved in a gallon of water.

Effects of want of Salt.—Experiments have shown that animals deprived of salt, other than that naturally contained in the food, soon get heavy and dull in their temperament, fall off in condition, and have a rough and staring coat. The process of digestion is materially interfered with, and they become in every way liable to contract disease. It has also been proved that animals which do not find sufficient salt in their food or drink become less prolific, and the breed deteriorates.

		Doses.
Purgative (to empty the bowels)	Buffalo ...	1½ to 2 lb.
	Ox ...	1 to 1½ ,,
	Sheep and goats ...	1 to 2 ounces.
Alterative (to alter the constitution from a diseased to a healthy state)	Buffalo ...	2 to 3 ounces.
	Ox ..	1 to 2 ,,
	Sheep and goats ...	1 to 2 drachms.
Stomachic (to improve the appetite and promote digestion)	The stomachic dose may be looked upon as a proper daily allowance for animals in health.	

To half-grown animals, give half the dose.

Endorsement by W. Wilson, Esq., Director of Revenue. Settlement and Agriculture, dated 20th June 1883.—

OFFICIAL PAPER.

EXPERIMENT IN SERICULTURE.

From J. B. Fuller, Esq., Director of Agriculture, Central Provinces, to the Secretary to the Chief Commissioner, Central Provinces,—No. 304, dated Nagpore, the 23rd July 1883.

I HAVE the honor to submit the following report on the experiment in Sericulture which was conducted in Chindwara during February, March, and April of the current year.

2. The object of the experiment was to discover whether the climate of the Satpuras was suitable for growing Japanese silk on the system which is followed in the Dehra Dun. The peculiarity of this system is that only a single crop of cocoons is raised in the year, whereas in Bengal several crops are raised in succession. The eggs are hatched at Dehra in February, and the cocoons are ready by the end of March. The eggs which are retained as seed for the next year's crop are then sent up to Mus oorie, where the comparatively low temperature prevents them from hatching until brought down again to Dehra in the February of the following year. In Bengal, on the other hand, the eggs resulting from the spring crop of cocoons are allowed to hatch out during the rains, and the eggs resulting from the rain crop are allowed to yield a third crop in the autumn. The deterioration of Bengal silk has been ascribed to this (the polyvoltine) system of culture. The rain and autumn crops of worms have to endure a climate which is unsuitable for them, and the breed becomes in consequence permanently enfeebled. The choice between the Dehra and Bengal systems lies between having one crop of good silk in the year, and having several crops of silk of poor quality.

3. In Circular No. 24 F. and S., dated 5th June 1882, the Government of India, in the Department of Revenue and Agriculture, offered to supply the Administration of these Provinces with 2 ozs. of silk-worm eggs from Mussoorie if an experiment was undertaken with them. For successful silk-growing, it is necessary that the climate should not become very hot until the worms have finished spinning their cocoons, that is to say, until the end of March or beginning of April. In this respect the climate of the Satpura districts in these provinces most nearly resembles that of Dehra. The station of Chindwara stands at a height of over 2,000 feet above sea level, and has a climate typical of the Satpura region. There were a sufficient number of mulberry trees in and around the station to provide foliage for a small trial. It was accordingly determined to make the experiment there. So far as management was concerned, the experiment was made under exceptionally favourable circumstances. The Deputy Commissioner, Mr. Tawney, took a lively interest in it, and made excellent arrangements for its proper conduct. The immediate charge of the experiment was committed by him to Mr. DeLange, second clerk in the district office who carried out his instructions zealously and carefully, and has submitted a very good report. Since no one in Chindwara had any practical acquaintance with silk-rearing, it was considered advisable to import a trained man from Dehra, who does not however seem to have rendered much real assistance. His pay and travelling expenses (Rs. 158-14-2) constitute the heaviest item in the cost of the experiments.

4. Two ozs. of Japanese eggs were received from Mussoorie on February 10th, and between that date and February 25th, 3 oz. was hatched out by exposure to the sun. This is calculated to have yielded some 80,000 worms. Hatching was then discontinued, since it was believed that the supply of mulberry foliage would not be sufficient for a larger number of worms,—a belief which was found to be incorrect as events showed that the mulberry trees which Chindwara contained could have supplied food to eight times this quantity. The hatching out of the worms has to be so timed as to take place when the mulberries are coming into new leaf, and might in the present case have been effected sooner with advantage. Mr. Tawney believes that February 5th is, in ordinary years, a safe date to calculate upon.

5. It was originally intended to erect a cheap rearing shed of brushwood, but it was found possible to utilize an old brick cattle-shed, which suited the purpose well. The treatment of the worms is described as follows in the district report :—

"As the worms were hatched each day they were put into bamboo trays, with the date affixed, and fed on tender leaves, cut very small.

"After a few days the stronger worms would come to the top, and these were again removed to other trays bearing the same date; and so on, till the contents of each tray were distributed into several other trays, to prevent overcrowding. The worms were not handled, but removed from tray to tray by means of small pincers, the leaves being lifted with the worms on them.

"For about 20 days they were kept in trays and then removed on to the tables, when they were fed on whole leaves. The tables were cleaned every second day."

For the first 20 days the worms were fed on detached leaves cut into small pieces. After this leaves were given them in branches, twigs and all. The leaf given to the worms each day was carefully weighed, and the total weight of foliage used in the experiment was found to be 59 maunds. The superficial area of the trays in which the worms were reared was 130 square feet. This is one-third more space than that allowed in Italy, but one-fifth less than the space which was found necessary in the Dehra experiments.

6. The mulberry trees in Chindwara were of two varieties, one having much thicker leaves than the other. Mr. Duthie, Superintendent of the Saharunpore Botanical Gardens, to whom specimens of both varieties were submitted, pronounced the thicker-leaved one of the two to be *Morus atropurpurea*, and the other to be *Morus indica*, the mulberry ordinarily used for silk-growing in Bengal. The Dehra silk-rearer from the first preferred the thicker-leaved variety, and the results have shown his preference to have been justified. The worms fed on each variety were kept carefully separate, and the thick-leaved mulberry has been proved to yield much the best silk (see para. 12).

7. The first cocoon was spun on March 22nd, thirty-two days after hatching. The following arrangements were made :—

"To enable the worms to make their cocoons, whole branches with leaves were spread over them, the leaves serving as food for those that had not commenced at yet; other contrivances were also made by tying 3 branches of cypress together and spreading them like a triangle over the worms; to these they took readily, and the cocoons made on these were cleaner and better than those made under the leaves and branches of other tables."

8. It is interesting to note here the temperature which the worms had to endure. It was recorded three times daily, at 7 A. M., 2 P. M., and 10 P. M. The highest temperature registered up to March 19th, was 90°, which occurred on five days before that date. The lowest temperature registered was 68°. On March 20th and 21st, the thermometer marked 92°, and on March 22nd rose to 94°, which was the maximum registered on each subsequent day of the experiment. After March 22nd the minimum was never below 72°, and on several days the thermometer never fell below 82°. Water was sprinkled on the floor of the shed to keep the temperature down, but it is probable that it was considerably hotter than a grass shed would have been.

9. The cocoons were weighed as they were cleared each day from the tables, and their total "green" weight was 41 lbs. 12½ ozs. A portion of them were "sun-dried," the chrysalides being killed by exposure to the sun. Another portion were "steamed" at my suggestion in the simple manner used by rearers of tussar silk in Chuttisgurh districts. The process is described in the report as follows :—

"The steaming was effected by means of 2 pots; the lower was half filled with water; and a wire flour sieve was put on its mouth into which the cocoons, a pound at a time, were put; the other pot, its mouth having been broken off, was inverted over the lower one, so as to prevent the steam escaping. Within 15 minutes of each steaming the chrysalides were killed thoroughly, as was tested by opening a few. The steamed cocoons were then dried in the shade, weighed and put away."

10. When thoroughly dry the cocoons were re-weighed and amounted to 14 lbs. 14 ozs. They had therefore lost two-thirds of their weight, those which were "steamed" losing rather less weight (62 per cent) than those "sun-dried" (66 per cent). They were then despatched to Messrs. Thomas and Co., Brokers of Calcutta, who had kindly engaged to have the silk spun and valued. The spinning was effected in the Berhampore factories of the Bengal Silk Company. The cocoons yielded 4 lbs. 5 ozs. of spun silk, and the following products possessing mercantile value :—

					oz.
Tape Chassum	...	...	...	...	10
Feshwa No. 1	...	...	...	...	½
Feshwa No. 2	...	...	...	...	1
Godhur	...	...	...	...	2½

11. The success of the experiment depends upon the quantity, as well as upon the quality of the silk produced. As regards the quantity of produce, it is possible to test the results by comparing the proportion of cocoons to eggs and of silk to cocoons with the ratios which are accepted as the standard in works on Sericulture. This comparison is effected below :—

	Standard	In the experiment under report.
One oz. of eggs yield ...	from 20 to 23 lbs. dry cocoons. ...	19·8 lbs.
Four lbs. of dry cocoons yield	one lb. silk ...	1·16 lbs.

The ratio of cocoons to eggs is very nearly up to the standard, while the ratio of silk to cocoons is above it. This is one of the most satisfactory points in the results, since it proves that the cocoons were above the average size and weight.

12. The best indication of the quality of the produce will be afforded by quoting the Calcutta report. Of the cocoons Mr. Stocks, the Manager of the Berhampore silk factory, writes :—

"I went through the cocoons carefully and weighted them. The *sun dried* and the *steamed* appeared much of the same quality. I preferred the latter, and they have given better produce, The double cocoons were not more that 3 per cent, and the useless ones 1 per cent. I should say that these two lots were worth Rs. 3-4-0 per seer *dry*. The *sun-dried China Mulberry* ones were a poor lot,—2 per cent of double and one-fourth stained. I should say Rs. 2-8-0 per seer *dry* a high value for them.

"The silk is very good from the thick-leaved Mulberry cocoons, but you will find it does-not open so freely as good silk should ; the great heat required to unwind the cocoon is to blame for this."

"I made the silk 12-13 deniers, and it was carefully reeled so."

It is noticeable that the worms fed on the thicker leaves of the two varieties of Mulberry (*Morus atropurpurea*) gave much better cocoons than those fed on other variety (*Murus indica*), termed the China Mulberry in the above report.

The Brokers' report on the spun silk is as follows :—

"We have examined the two large bundles of raw silk the produce of the *sun-dried* and *steamed thick-leaved Mulberry cocoons*.

"There is no noticeable difference between either of these bundles or the three skeins from the *sun-dried China Mulberry*. We report the quality to be decidedly good ; the colour is a good white, but in some skeins there is a slightly greenish tinge and in others a leaden shade. It is also very clean : some slight show of small knit, but hardly worth notice except in a critical report : the size is 12 to 14 deniers, but is not so reliable in this respect as we should like to see it. However, without some experience of the yield and nature of the cocoons the reelers are handling, they are at a great disadvantage ; in the present case we consider the reelers have been quite as successful as could be expected—the silk winds very well.

"The *yellow skein* we have not opened, as we think you would like to receive it in a fresh state ; it doubtless will bear just as good a report as the others ; the only special remark to make is. though the colour is bright, it is not of the *brightest*."

It will be noticed that no market value is quoted for the silk, because, in the words of the Broker's report—

"If valued as Bengal raw silk we could not put put the value higher than Rs. 16 to Rs. 17 per factory seer, whereas it is the writer's opinion that if the silk be submitted for valuation in Europe and is not supposed to be Indian or Asiatic silk, it will be valued at about 30s. per pound in London, running certain kinds of European reeled silk, to wit, Broussa, very close.

"We could suggest that you send forward the samples to London, Marseilles or Lyons for careful report and valuation, but if this be done the writer ventures to counsel you, if you desire to get a perfectly unbiassed report and value, to take some pains to disconnect the silk with India, with which object Indian tickets, paper and packing should be destroyed, and skeins should not remain bundled and tied up as now in packets of three and four ere they pass into the hands of the expert at home. On no account send forward any of the cocoons—chassum or other waste : these would serve as a connecting link.

"In conclusion we have only to remark that the Bengal Silk Company work the filatures formerly owned by Messrs. James Lyall and Co. This company would like to secure a good supply of such cocoons as they have reeled for your department, and we and they will be glad to learn that your department sees its way to increase the production and to know at what rate this is expected to take place."

The silk was therefore of a quality greatly superior to that ordinarily produced in Bengal, and equal to certain classes of European silk.

13. Messrs. Thomas and Co. have favoured me with the following additional remarks on the waste products (Chassum, &c.) mentioned at the conclusion of para. 10 :—

"Besides the raw silk produced from the cocoons we return you the waste or refuse, which some 20 years ago had only a nominal value."

Tape Chassum appears very good of its kind, but we can't say that the valuation we now put on it of Rs. 175 *per factory maund* would be obtainable, because it is *white* ; as a rule, there is a prejudice against *white Bengal Chassum*, because at the dyepot the white of Bengal silk and Chassum can't be relied on as true white, and not being a yellow, it becomes a bastard colour. But in the writer's opinion this white Chassum will prove perfectly reliable as a white silk. and with consumers's minds set at rest on this point, the valuation of Rs. 170 ought to-day to be obtainable. Rs. 170 is an extremely high value. This class of Chassum has never sold so high in former years. Last year Rs. 160 was the rate, the previous year Rs. 140. Before these years the price ranged between Rs. 125 and Rs. 140 per factory maund.

Feshua No. 1 is worth nearly as much as the Tape Chassum, selling along with it in the contracts we pass.

Feshua No. 2, worth about Rs. 80 per factory maund.

Godhur or Low basin waste and husks, worth about Rs. 20.

14 The experiment may therefore be pronounced to have been a complete success. It was, it is true, on a very small scale, but the results are sufficient, I think, to establish beyond doubt that excellent silk can be grown in the Satpura tract, if eggs were imported from Mussoorie, and only a single crop taken in the year. And in addition to this, the experiment was conducted with so much care, as to furnish a number of reliable *data* which will be extremely useful in the event of sericulture being taken up on a large scale. On this subject, which is directly connected with the extension of mulberry plantations, I will do myself the honor of addressing you in a separate communication.

15. The total cost of the experiment was only Rs. 292-14-6, considerably more than half of which (Rs. 158-14-2) was incurred on the salary and expenses of the silk-reaver imported from Dehra. Economy is therefore another point for which Mr. Tawney is to be congratulated on his management.

J. B. FULLER,
Offg. Director of Agriculture.

SELECTIONS.

THE ONTARIO AGRICULTURAL COLLEGE.

By Prof. W. A. Henry.

IT was early on a bright morning of the present month that I started from the hotel in Guelph for a visit to the Agricultural College. Leaving the quiet little city with its walls of dull, grey limestone behind, I passed out on the Dundas-road, and after a brisk walk of a few minutes found myself at the college gate. The first rapid swoop of the eye over the scene brought nothing very interesting or striking to view ; in the background on a rise of ground fronting me stood a long three-storey building of the same gray limestone as that used for buildings in the city. This main building was flanked on one side by a couple of neat dwellings, and on the other by a cluster of barns and out buildings, while in front of these last, half hidden in the trees, stood a green-house. The grounds in front of the main building were treeless, and having been recently ploughed up, lay bare and brown.

To one brought up in the United States where the idea largely prevails that immense buildings are prime factors in the make-up of a college, the sight was not very prepossessing, and yet this institution, situated away to one side of the centre of our American civilization and almost on the outskirts, has of late attracted much attention from those studying the problem of industrial education, and caused many persons like myself to make long pilgrimages, even in some cases from across the Atlantic to study the causes of its success. In the United States we have scores of colleges with buildings far more massive than these, and whose age renders them venerable compared with this new thing, yet their fame has scarce extended across the borders of the county in which they exist.

But I have kept the reader entirely too long outside the grounds contemplating the earthy campus and the gray-stone buildings. I was not long in making my way to the office of the president, James Mills, who gave me such a welcome that I felt at ease at once. With him as guide, the professor of agriculture was soon found, and I now had my two main sources of information at hand. Let me give to the reader some of the facts gathered.

This college accommodates 130 agricultural students, who all reside in the main building under the direct supervision of the president. Each candidate for admission has to pass a thorough examination in the common English branches upon entering. The course of study is two years in length, and is made to combine both the practical and theoretical. All students naturally fall into one of the two classes—"First Year" or "Second Year" students. Each class works daily five hours in the fields, barns or workshops, and have five hours for study and recitation. The work and recitations of the two classes alternate ; thus, while the first-year boys are with the professors in the class-room during the forenoon, the second-year students are employed, under the guidance of proper superintendents, at manual labor in the fields, barns or shops. During the afternoon the order is reversed. For this manual labor the student is allowed from four to ten cents per hour, according to his ability. His earnings are credited on his board account. For board, washing and lights the cost is about ten dollars per month. The cost of the year's schooling is, to a good, working student, not over sixty dollars per year for all expenses, except clothing.

All students are treated alike as to hours of labor, and the endeavour is to make each familiar with all the varied farm operations. To be sure, with only a two-years' course, and half of the day spent in the field, no extended course of instruction can be given ; yet, since no time is spent on any foreign language, the student is given a fair start at least in such sciences as botany and chemistry, and is given a good drill in English. The range of study and thoroughness is more than one would suppose at first thought. The average student leaves the college an intelligent man, if not an educated

one. It is in the practical operations that this school excels. Let me illustrate by showing how the young men are taught in regard to stock. When Professor Brown takes up this topic, his lectures are illustrated by the living animals. When talking about Short-horns, for instance, a bull or a cow of this breed is led into the lecture room and studied. Before the subject is left, several individuals are brought in at once and compared. After this course with each breed, representatives of different breeds are placed before the class, as Herefords, Short-horns and Polled Angus, and comparisons made. Nor does this end the matter. Each student must pass an examination upon these lectures, and in a most rigid way. When being examined the student is alone in the room with the stock, the Professor and some practical stockmen chosen for the occasion. It is not to be wondered at that these young men become very proficient in such matters. It is in ways like this that the whole farm is made to serve as illustration.

The farm is very complete, and I wish this whole paper could be given up to an account of it. It consists of 550 acres of choice land. There are twenty-one fields of twenty acres each; there are seven fine teams of work-horses and all sorts of farm machinery, without limit, almost; there are on the farm seven breeds of cattle, six of sheep and three of swine.

The college is now about to take a step in advance. Several years ago, $10,000 were spent in blooded stock. This has paid handsomely, as over $15,000 have been realized for surplus stock sold out of this herd. This fall they propose to hold a clearance sale and re-stock the farm with a larger number of animals of a higher type. Not only is there to be a great change in the stock, but the college grounds are to be metamorphosed. Mr. Miller, who laid out Fairmount Park, Philadelphia, has been employed to remodel the grounds, and the work has already begun. This accounts for the large lawn in front of the main building being ploughed up, as mentioned at the beginning of this article. In place of their present small green-house they are to have one costing over ten thousand dollars, and all the barns are to be torn down and new ones built on a new site. These progressive changes are a measure of what the Ontario people think of their agricultural college.

President Mills informed me that if he wished he could fill this school with young men from England alone, and that the cities of Canada would over half supply the list. His endeavour, however, is to have the sons of farmers from Ontario fill the school. So long as this is not the case outsiders will be admitted. Last year sixteen young men from England were in attendance, Ireland and Scotland sent three each, and Turkey, Wales, the United States and West Indies each sent one. Each term he has to refuse many applications for admission. President Mills says that so far as he knows *every student who came to the College from the farm has gone back to the farm when through*. Let those who claim that education drives young men from the farm ponder over this statement.

The reasons for the success of this school can be found in the men and the methods. Those in authority have turned themselves squarely to the farmers of Ontario, and sought to know what under present conditions should be taught to their sons to make good farmers out of them. They have not looked to classical colleges for guidance, but have been governed by the needs of the common people. Who could expect anything but success when such methods have been employed? No wonder money is beginning to flow towards this school like water, and both political parties of Ontario are claiming the college as their own particular child. Without fear of successful contradiction, I call it the model agricultural college of America. Less than ten years of age it is fairly rooted in the hearts of the farmers of Ontario. How can it have other than a bright future?

It was the afternoon of the second day when I closed my visit. I felt as I left that I could profitably stay a week studying the reasons why this young school was so rapidly gaining distinction. —*Farmers' Review.*

AGRICULTURE IN MOZAMBIQUE.

THE only agricultural industries that can be said to have firmly and successfully established themselves in the province of Mozambique, appear to be those of the cultivation of the oil-producing plants, *Amendoim* and *Gergelim*. The production of these, says Consul O'Neill, together with the collection of India-rubber, calumba root, and orchilla weed, forms five-sixths of the total exports of the province. This cultivation, and the labour requisite for the collection of the latter products mentioned, is conducted solely by the natives. Efforts have been made, from time to time, by the Portuguese and other colonists, to introduce the cultivation of other produce for which both the climate and the soil are especially favourable, but none have been thoroughly successful. Of the greatest importance have been the endeavours in various parts of the coast to raise sugar, opium, tobacco, and coffee. As the cultivation of *amendoim* and *gergelim* is entirely in the hands of the natives, it follows, as a natural consequence, that every stage of the working is of a most rude and primitive kind. The thousands of acres that are utilised in the cultivation of the seeds are cleared in great part with an axe of native make, of tomahawk shape, and with an edge hardly two inches in length. In some parts, particularly in the European settlements, a species of bill-hook is also used for clearing the undergrowth, but these two form the only tools of the Makua forest-clearer. The vast area of country cleared is then turned over by both men and women with a rough and clumsy hoe, also of native make, the slow working of which entails an enormous and unnecessary consumption of labour. In the sowing of *amendoim*, holes are made in the ground some little distance apart, generally three or four feet, to allow space for the creeper to radiate. This is usually done with a sharp-pointed stick. One seed—care is taken that it is only one, as the natives declare that the growth of two or three will strangle each other—is then dropped in each other hole, and the earth stamped over by the feet. In the sowing of *gergelim*, the seed is broadcast as with grain, and scattered thickly over the ground. The sowers are then followed by others with hoes, who work the seed roughly into the ground, stamping the whole in with their feet. Care and therefore much labour is required to keep the ground clear of weeds that spring up in this climate and soil with astonishing rapidity, and throughout the growth of both these plants, the plantations are carefully tended. In the reaping or collection of *amendoim*, the plants are simply pulled up by hand, and the tubers taken off as with the common potato. They are then laid out to dry in the sun, and when thoroughly dried, are shelled by hand for the extraction of the seed, an operation requiring considerable time and patience. With *gergelim* the plant is in some districts literally reaped, but slowly and by hand, with an ordinary knife. In others the plants are simply pulled up out of the ground; in the latter case they are then cut about a foot down the stem. The plants are now tied into small bundles, which are struck in the ground in the sun till thoroughly dried, when the seed will drop readily off. Large mats are then spread on the ground, the bundles taken up and shaken vigorously over them till all the seed have thus been extracted. With both *amendoim* and *gergelim* the seeds are then packed in baskets of native manufacture, and carried on the heads of the blacks, in some cases a distance of fifty or sixty miles, to the house of the coast trader, there to be bartered for cloth, beads, power, &c., and to be stored till an opportunity occurs. The sugarcane is cultivated by the natives upon most parts of the coast where alluvial soil exists, but only in insignificant quantities, and to be used by them as a sweetmeat, or for the purpose of chewing. The only part of the province where its growth has been attempted upon any considerable scale is in the rich soil of the Zambesi delta, and by the Portuguese planters of that district; numerous plantations exist there, and the cane grows luxuriously upon them. The only use, however, to which the cane has, up to the present time, been put, is that of the distillation of spirits. Consul Baring says, that beyond the Zambesi, there are many places in the province eminently adapted for the growth of the sugarcane, and which possess easily accessible and secure ports for discharge and shipment. Amongst these may be mentioned Mwambi Bay (Pemba), Mwendazi (Mwemba), the western shores of Nakaha and Nihogehe, on the branches of Fernao Veloso Bay, and the country to the south and in the vicinity of Mokambo Bay. Tobacco, though cultivated as an article of commerce for export, has not met with much success, as the passion for the weed has become deeply rooted in the natives of the coast and interior, so that it is cultivated by them in many parts of the province for their own consumption, and forms a regular article of sale and barter amongst themselves. The tobacco leaf is dried very carelessly by the natives, and is made up in a peculiar way, as follows:—It is first plaited, and when the plait has reached a length of three or four feet, it is wound up in the form of a spiral. Gradually drying in this shape, it preserves its form without any binding, and it is unwound and cut off in short pieces when required for use or sale. This mode of preparation is invariable among the Makua and Yao, between the Rovuma and Zambesi. Consul O'Neill says, that "were the natives instructed in some simple method of drying and ——— the leaf, the valuable product would be probably brought down by them in considerable quantities, affording, as it would do, a larger margin for profit than does the culture of oil seeds, and it might become a regular article of colonial manufacture and export." Among the many plants useful to commerce that grow wild on the coast land and interior of Mozambique, may be mentioned the castor-oil plant, the senna plant, a species of sarsaparilla, the capsicum, or common red pepper, used by the natives with their food, but as yet not gathered by them for sale, in spite of the efforts of some merchants to induce its collection; and the pine-apple, the fibre of which has been lately proved to be a valuable substitute for flax.—*Journal of the Society of Arts.*

FRENCH AGRICULTURE.

THE supply of Percherons is falling short, and the Government is anxiously studying how to remedy the evil. Two measures are under consideration to prohibit altogether the exportation of the horses, and to augment the number of State breeding studs. Le Perche, from which the name of the race of horse in question takes its name, was an ancient region of France, and with Beance, may, for general purposes be included in Normandy. It is a country full of beautiful valleys, is fertile, well-watered, and containing fresh pasturages of excellent quality. The soil is argillaceous, but not impervious. At the same time the water does not pass off rapidly. Thus it is favourable for herbages, including among others, peas, vetches, and sanifoin, and in some instances lucerne. The country, too, is well wooded, thus affording shelter and shed for the animals. There is no proof that the Percheron horse is of Arab origin. From time immemorial, from paintings and tapestry work, he appears to have been a good, general animal, of which a selected number were kept for draught. Till last century the breeding and rearing of these horses was a monopoly in the hands of the rich land-owners and the monasteries. The young Perchon in those days remained in the country till the age of four years, and was purchased on the farms in Perche and Beance, as also in the fairs of Eure-et-Loir. Here the dealers from Paris came to make their choice for posting and carriage horses. The army buyers, too, competed for the wants of the

cavalry, and above all, of the artillery. The present practice is more varied. Some sell the foals at the moment of weaning. Others buy them at the age of six months, and sell them when thirty months old. While, again, in the Beauce, the animal, bought when two-and-half years old, is trained to light work, and sold when aged five years, at a good profit, their work and manure paying for their keep. Strabo relates that the Satrap of Armenia sent every year to the King of Persia 20,000 young horses for the fete of Mithra. The supply of Percherons is not equal to this, but the demand is endeavoured to be met by spurious animals sent from the neigbouring departments, especially from Bretagne, Anjou, Maine, &c. The foals are left to suckle their mothers for five, six, or seven months; those that are not weaned till eleven months are not considered so good as the others. The foal begins to follow its mother from the ninth day, and, when aged about two months, commences to take solid food. Weaned ordinarily at six months, the foals are allowed to live together till the age of three years. Shoeing is undertaken at this age. The fore-feet are shod first, and six months later, the hind feet. In Le Perche the farmers select the mares best suited for their purpose, and what most contributes to give fixity and homogeneity to the race is, the exigencies of Paris, which requires animals strong and full-bodied. Hence there is a uniformity of aim in selecting mares. The same observation applies to stallions, which chiefly come from the Beance, though they may have left Le Perche when very young. Although in the latter country there are mares of all sizes and corpulence, there is a family likeness among them all, due to climate and local causes. Farmers have land of various qualities, and place thereon foals of different varieties; food becomes thus adapted to special types. The great point with the breeder is, to have a good mare. With a good mare you will have good fillies. If you want bus and cavalry horses, reject all Arab and English blood. If you want horses for the saddle, keep such blood. There are two classes of Percherons, the large and the small, the former being frequently confounded with the Boulonais foals. Whether light or heavy the Percheron is required for the rapid transport of vehicles and goods, and ought to unite all the elements of zootechnic beauty in bone and muscle. The eyes ought to be large, the head small, and tapering towards the nose and mouth; skin fine, no coarse hair, head elegantly placed, and the shoulders well detached from the withers. The body of the mare, always longer than that of the horse, must not be too long; back straight and horizontal with croup; trunk of tail thin and springing well from the height of the croup; a broad croup indicates good action in hind legs, as a wide chest presumes the same in the fore-legs. The legs ought to be straight, large, and possessing little hair—tufts of hair and thick skin indicate liability to illness. A skin, fine to touch and sight, ought to characterise the whole body. Grey-colored animals are not to be rejected. Avoid animals with hard tumors on the legs, &c.; the feet should not be too small, nor too large. The stable ought to be well-aired by ventilating chimneys, and light freely admitted. In the fields the colts ought to be sheltered. In Hungary such is effectually secured by three walls. Feed well without producing fatness. A mare ought always to be in good condition. Carrots and parsnips are excellent. Indeed foals have been reared on carrots alone. Water breeding mares twice a day. If from a well, allow the water to acquire the temperature of the surrounding air, or employ a handful of bran. A little salt is good. When 2½ years old, when the first milk teeth commence to fall, colts can be set to light work, avoiding as much as possible that of a pulling or violent nature. In fact the first efforts ought to be exercise, not labor. In conclusion, to have pure Percherons, purchase them on the spot from the breeders. M. Schultz of Lupitz, Germany, is creating something like a sensation by his system of culture of sandy soils, rotating potatoes, rye, clover, pasturage, and lupin. His theory is, that lupin especially, and clovers, fix atmospheric nitrogen in the soil the more so when aided by the salts of potash, if applied in the form of kainite, which is but sulphate of potash. As for atmospheric nitrogen, &c., that is a point on which scientists are not at all agreed. But deep-rooting plants like clover and lupine (from *lupus*, a wolf, its roots being so penetrating and voracious), may induce combination in the organic matters of the soil, so as to induce nitrification more largely. M. Schultz employs a good deal of marl, an essential for lupine. He applies 4½ cwts of kainite per acre, and obtains in lupine a yield of 19 cwts. of seed and 1¾ cwts. of straw. While not accepting as demonstrated, that potash favors the absorption of atmospheric ammonia, it renders the phosphoric acid in the soil soluble, augments the consistency of sandy lands, keeps the earth fresh, and so aids vegetation. Harvest operations in the south of France are disappointing, but in the central and northern regions the yield is expected to be more satisfactory. The vines sadly want heat. The flowering, the critical stage, passed off most satisfactorily. As for the phylloxera, its march is ever forward. The malady is eating its way surely over France. Prospects of sugar beet are excellent. M. Bouley still maintains that it is better to feed pigs on the cooked carcasses of diseased animals than to bury the latter.—*Madras Mail.*

FRENCH AGRICULTURAL NOTES.

DURING the season of sugar-making the manufacturers employ the services of young chemists, at 200 fr. per month, to analyse the beet offered for sale, and on which the price depends. The season terminated, the chemists are dismissed, hence, the difficulty of obtaining their services later. It is proposed that for the future the sugar manufacturer employ the chemist all the year round; that in the slack period he could superintend experiments affecting the growth of several varieties of beet, the distances at which it is best to plant them, the efficacy of several manures, &c. It is also proposed that the fabricants supply farmers, and at wholesale prices, not only with seed, but with appropriate manures. The prospect of the beet crop is excellent; the weather is propitious for the young plants.

Head Veterinary Inspector Bouley confirms his assertions, that the flesh of animals killed in the knackers' yards, even those diseased, can be given without danger, if well cooked, to pigs during their growth. It must be discontinued, however, during the fattening stage.

Marcs, or the residue of the wine-press, have proved to be as good as pressed beet-pulp for feeding. Hitherto they have not been utilized. Sheep thrive well on the diet. It is best to employ marcs for the first feed of the day, and to mix with the other rations. A little oil-cake makes an excellent mixture.

There exists an erroneous impression that for ensilage or trench food a special variety of maize is necessary. This is not so. All varieties have alike been tested in France without any difference being perceptible. The main object is to obtain the seed free from damage, so that its germinative power shall remain sound. The next end is to sow in lines from 10 to 20 inches apart. This allows of weeding; larger spaces induce the growth of thick stems, which necessitate the use of the chaff-cutter before the stuff be trampled into the trench. Maize for ensilage can be sown from May 1 to July 12; but in France, that sown between May 15 and close of June succeed best; 1½ cwts. of seed to the acre. The special manures consist of nitrate of soda, superphosphate of lime, chlorate of potash, dried blood, or wool-dust; bone-dust can supersede the superphosphate in many soils, and when farm-yard manure is employed the fertilizers can be reduced by two-thirds.

M. de Rolliere's plan of preserving eggs fresh is worth knowing, since it is practised by merchants who deal so with twelve millions of eggs annually. The eggs, when laid or quite fresh, are gently struck against each other, to see if they be "sound;" next they are placed in a kind of earthen pitcher, having a very narrow bottom; when the vessel is full, a solution of quarter of an ounce of quick-lime to one quart of water is poured in. The lime water permeates the shell till it reaches the first membrane, rendering the latter impervious. The pitchers are then placed in a cellar, from where all light is excluded, but a uniform temperature of 44 to 46 degrees Fh., uniformly maintained. In the course of a few days a pellicle forms on the surface of the water in each pitcher—carbonate of lime—and that must never be broken till the moment for withdrawing the eggs. This process enables the eggs to be kept fresh for 6 to 8 months, and not more than five in a thousand prove objectionable.

A gardener keeps his frames and hothouses free from slugs, by mixing sulphate of copper with wheaten bran. The odour of the latter attracts the enemy to certain death. Keep poultry, however, from the stuff.

The vineyards are in excellent condition. Unhappily, the phylloxera continues its onward march. Of all the remedies propounded, autumnal inundations, followed by good spring manurings, is the most popular. All attempts to acclimatise the tubercular annual, Soudan grape, in France, have now been abandoned.—*Farmers' Review.*

BREEDING SEED GRAIN.

THE term "breeding," as applied to grain, will be regarded as misapplied. But it more clearly represents the idea in the mind of the writer than any other that could be chosen. Stock-breeding has for years engaged the attention of scientific and practical men in this and Europe, and the results are seen in the improved breeds of horses, cattle, sheep, swine and poultry throughout the country, while their influence in grading up the common stock is seen on almost evey farm and ranch. The gardeners, nurserymen, seedsmen and florists have brought about great improvement in vegetables, fruits and flowers, improving old varieties, and devising new and valuable ones. But no such careful, painstaking, scientific effort has been directed to the improvement of the seeds of grain which form the staple of the farmers' crops. If improved varieties have been introduced they have largely been the result of accidental hybridizing or have been brought from distant localities, and under new conditions have for a time proved superior to varieties previously grown. There has been no careful *breeding* for improved varieties or improvement in quality, as has been the case with the live-stock men, the gardeners, nurserymen, and florist. It is, perhaps, incorrect to say there has been *no effort* in this direction. What is meant is that it has not by any means been general, or to any such extent as to make itself felt in the agriculture of the country. It has in no case passed beyond the stage of experiment in the hands of few individuals; yet such experiment indicate, if indeed they do not demonstrate, that by a careful system of "seed-breeding" as great an improvement can be made upon the grain crops of the country as we already see has been wrought in the live-stock interests, the improved quality of which is not only a source of greater profit to the individual farmer, but adds immensely to the value of our resources as a nation. The average yield per acre of wheat and corn in this country for the past ten years has been (omitting fractions), twelve bushels for wheat and twenty-seven for corn. If by improving the quality of the seed of these two crops the yield, without improved culture, could be increased 50 per cent, it would add to the annual income of the farmers of this country on the basis of last year's yield, at $1 per bushel for wheat and 50c. for corn, no less a sum than 670,000,000 of dollars, equal to over $13 per capita of our entire population, and yet it is morally

as certain that by pursuing as careful a system of seed breeding as has been pursued in stock breeding, such an improvement could be wrought out, as it is that a thorough-bred or grade short-horn or Hereford steer is worth more and pays a larger profit than the native scrub. The same principle of breeding is applicable in both cases. Selection of the best and breeding or propagating from that, taking care that the stock is not allowed to deteriorate. In live stock the selection is not difficult. In grain, how to select the best is a more difficult problem. But it is being thought out by clever and enthusiastic experimenters. The pioneer in this movement, so far as is known to the writer, is Major Hallett, F. L. S., of Brighton, England, who commenced his experiments in 1861, and has since continued them, an interesting account of which appeared in the July number of the *Popular Science Monthly*. He finds that in the cereals no two grains or kernels are exactly alike in productive power. That in every head of wheat or other grain there is one kernel, which greatly excels all the others in vital power, and which will transmit to a greater or less extent its character to all the grains produced from it. Of eighty-seven grains of wheat from two heads planted by him under precisely the same conditions, and in the same plot, one produced ten heads containing 688 kernels. No other grain produced anything near this, and the finest ten heads selected from the plot only gave 598 kernels, or ninety kernels less than the product of this one kernel. The next year he planted the grain from the largest head of the plant which produced ten ears, planting in a row singly, twelve inches apart. One of the kernels produced a plant which produced fifty-two ears. While the plants on either side of it in the row produced seventeen and twenty-nine ears respectively, and the finest of all the other plants produced forty ears. The same system of selection was pursued each year, the results being that the length of the ear was doubled, its contents trebled, and the tillering or stooling-out capacity increased five times. The general principles wrought out, or the law of vegetation discovered by these experiments, is summarized as follows:

1. Every fully-developed plant, whether of wheat, oats or barley, presents an ear superior in productive power to any of the rest on that plant. 2. Every such plant contains one grain which, upon trial, proves more productive than any other. 3. The best grain in a given plant is found in the best ear. 4. The superior vigor of this grain is transmissible in different degrees to its progeny. 5. By repeated careful selections the superiority is accumulated. 6. The improvement, which is at first rapid, gradually, after a long series of years, is diminished in amount, and is eventually so far arrested that practically a limit to improvement in the desired quality is reached. 7. By still continuing to select, the improvement is maintained, and practically a fixed type is the result.

The practical value which these experiments and results have for the farmer is in this, that when a superior variety has by a long course of experiment been developed, and its character fixed, its multiplication for purposes of seeding is so rapid that in a few years it can become widely disseminated among the farmers. The variety of wheat known as the "wild goose" wheat, it is claimed, was all propagated from a single grain taken from the craw of a wild goose. The origin of an Egyptian wheat is claimed to be a few kernels found in the wrappings of an Egyptian mummy. The development of improved varieties of corn is now claiming the attention of those in charge of our agricultural experiment stations and private investigators. Some important facts have already been developed, and important results may be looked for in the improvement of this crop. The farmer can easily pursue a course of experiment for the improvement of his seed corn. This requires a special patch, not necessarily large, to be devoted to this purpose. It should be at such distance from any other corn that by no possibility could the ears be fertilized by the pollen from any other field. As soon as in tassel, every barren stalk should be cut out that the fertilization will only be by fruitful plants. Selecting the best ears for seed, the same course could be pursued the next year, resulting unquestionably in a seed that would be vastly more prolific than the original seed. An interesting experiment would be to select for planting the experimental patch ears from stalks bearing two perfect ears, and remove not only the barren stalks, but the tassels of all on which two ears had not set, ensuring that the entire fertilization should be from stalks bearing two ears. The probable result of a few years of this practice would be to so fix the character of the seed that each stalk would produce two or more perfect ears.—*Farmers' Review.*

THISTLE-DOWN FOR TEXTILE PURPOSES.

An article on the subject of recent experiments with thistle-down appeared in the *Newcastle Daily Chronicle* of the 28th June, and was followed by a letter which will be of interest to our readers. The article was as follows:—

Considerable interest has been awakened in the textile trade by the recent announcement that a new fibre had been discovered in the shape of thistle-down. Under any circumstances, it is only natural that an announcement such as this should have caused a momentary flutter in manufacturing circles; but when our neighbour, Mr. Fenwick, of Stockton-on-Tees, is bold enough to prophesy that thistle-down will completely "revolutionise the textile trade," the matter immediately becomes one of more than passing interest. Thistle-down, we are told, is "as soft as silk, and almost equal to it in strength; piece-goods can be produced from it at half the cost of wool; for felting purposes it is destined to take a high position; whilst it will enter freely into competition with cotton, and also make the finest paper." If all this be true (and it is only fair to assume that Mr. Fenwick has reasonable grounds for making such emphatic statements), it certainly seems probable that thistle-down will ere long occupy an important place in our manufactures. But be this as it may, the fact remains, that certain manufacturers have been so much impressed with the "probabilities" of the discovery, that they are giving the matter their earnest attention at the present moment. The first point which, of course, suggests itself, is with regard to the practicability of using the down for textile purposes. Unfortunately we cannot have the advantage of Mr. Fenwick's personal experience. He is not a textile manufacturer, although he says that, for some years past, he has been "giving attention to the raw materials used by our Yorkshire and Lancashire manufacturers." It is not necessary, however, to go far afield to find some proof that thistle-down may be successfully manipulated in a variety of ways. Among the curiosities of the Dublin Triennial Exhibition of 1849 were to be seen two pocket handkerchiefs which had been made from thistle-down and presented to the Queen. The material, it is said, resembled the finest silk. We have also before us a letter from a large textile manufacturer in Huddersfield stating the results of a series of experiments which he made some years ago with the down gathered from the tops of rushes. It is obvious that although the down of rushes may be a good fibre for experimental purposes, it cannot be compared in texture with the down of thistles. Suffice it to say, however, that rush-down was found "easy of manipulation, and strong and sightly in staple." But a serious obstacle presented itself—the "down" could not be grown in sufficient quantities to remunerate the producer. Mr. Fenwick believes that no such obstacle as this will stand in the way of the adoption of thistle-down. Assuming that the experiments which are now being made by manufacturers turn out to their satisfaction Mr. Fenwick suggests that the vast tracts of waste moorland in England, Scotland, and Wales, should be utilised for the production of thistles. He believes it would pay the cultivator very handsomely if he sold his "crops" at a penny per pound. But what weight of thistle-down could be grown per acre? Mr. Fenwick puts the quantity down at three cwts., and he calculates the cost of cultivation so as to afford a handsome profit thus. Supposing that a tract of moorland of 5,000 acres is taken at 5*s.* per acre; this will represent a rental of £1,250 per annum. Then he puts down 2*s.* 6*d.* per acre as the cost of planting, gathering &c., which means another £625. To this he adds £150 as the salary of a general superintendent of operations, thus bringing the total expenditure up to £2,025 for the year. If then a crop of three cwts. were obtained every year from each acre of land and sold at a penny per pound, the income of the cultivator would be, in round, figures, £7,500, or an annual profit of £5,470! These are Mr. Fenwick's figures, and we give them for what they may be worth, without pretending to express an opinion as to the basis of calculation. It will readily be seen, however, how Mr. Fenwick has come to the conclusion that the hard-pressed agriculturist, may find a fertile source of profit by growing thistles instead of wheat! The question is one of widespread interest and importance. Mr. Fenwick has already brought it prominently under the notice of the India Office, and pointed out that the boundless tracts of waste land in our Indian empire would afford a splendid field for the growth of thistles. The discovery of new fibres is engaging the close attention of the Revenue and Agricultural Department of the Government of India just now. It is intended to make the extraction of fibres of all kinds a special feature of the International Exhibition to be opened at Calcutta next December; and, in view of this fact, it is not unlikely that thistle-down may be practically tested. In the meantime, people at home will await with interest the results of the various experiments which are now being made; and, should it be found that thistle-down possesses all the advantages which Mr. Fenwick claims for it, there is no doubt the supply would very soon become equal to the demand.

The letter in reply is dated July 4th, 1883:—

Sir,—Referring to your leading article of the 28th June on the above, it may be well to utter a note of warning, not against the adaptability of thistle-down for textile and paper-making purposes, but as to the danger of *cultivating* thistles on waste lands.

Thistle-down, being the seed of the plant, on ripening is liberated by the slightest breeze, and thus will travel for miles. If I am correctly informed, a home-sick Scotchman, who had settled in Australia, missing the sight of his national emblem, sent home for some seed, the result being, that once sown, the thistles propagated so rapidly as to become an utter nuisance, as they spread over a wide tract of country, it being almost impossible to eradicate them.

Fibres adaptable for paper-making, and some for textile purposes, can be obtained from nearly every plant of the vegetable kingdom, the questions to consider being suitability for the purpose and cost of production; to say nothing of the former, I am afraid the figures set down at 2*s.* 6*d.* per acre as the cost for planting and gathering would fall very far short of the mark, as well as the yield of three cwt. per acre.

Three patents were taken out in 1834 for the manufacture of paper from thistles, one by Lord Berriedale, a Scotch nobleman; but these were anticipated in 1800, by one Matthias Koops, a Dutchman, who published a book containing specimens of the thistle paper, also paper from wood, straw, hay, bean-stalks, and sundry other plants.

I am of opinion that anyone interfering with thistle will verify the truth of the motto "Nemo me impune lacessit"—No one touches me with impunity.—I am, &c.

THOS. RUTLEDGE.

There have been several patents for making paper from thistles, *viz.*, that of—

Matthias Koops ... No. 2433, August 2, 1880.
Ditto ... ... No. 2481, February 17, 1881.
Hon. J. Sinclair (Lord Berriedale) Gustave ... No. 1505, July 8, 1854.
Hermann Lilis ... No. 2303, October 30, 1854.
Auguste Edward Levado Bellford ... ... No. 2540, December 2, 1854.

GRAHAM'S PATENT WOOD PULP PROCESS.

MR. GRAHAM'S patent, of which a specification is now issued, does not differ so materially from that of Tilghman as to present very remarkable features.

The patent is for improvements in the method of treating certain vegetable fibrous substances for the production of fibres for spinning, paper-making, and other purposes, and relates to the method of treating such vegetable fibrous substances as are capable of producing fibres suitable for spinning, paper-making, and other purposes when treated by any of the known processes in which the fibrous substances are boiled or steeped in a solution of sulphurous acid, or a sulphite or bisulphite of soda, potash, magnesia, lime, or other suitable base and water, preferably in a closed vessel or boiler suitably protected from the action of the chemicals used (such a process being described in the specifications of English patents No. 2994, dated 9th November, 1866, and No. 385, dated 11th February, 1867, taken out by William Edward Newton as a communication from Benjamin Chew Tilghman), the boiler being fitted with a valve which can be opened so as to allow the gases and volatile hydrocarbons contained naturally within and around the fibres (either in chemical combination or mechanical adhesion therewith) to escape.

The main feature of Mr. Graham's claim is that in carrying out the process above described there is a constant loss of sulphurous acid gas going on, and consequently a continual weakening of the solution employed, in order to avoid which he employs the mono-sulphite (commonly called the normal sulphite) of potash, soda, magnesia, lime, or other suitable base and water.

Either of these substances or a suitable combination of any of them, and water, are placed in the boiler with the fibrous substances to be treated, and the temperature raised to, or above boiling point, and after the hydrocarbons, air, and gases natural to the fibrous substances have been driven out by the heat and allowed to escape through the valve provided in the boiler for this purpose, he pumps or injects into the vessel or boiler sulphurous acid either in its gaseous or liquid state, or in combination with potash, soda, magnesia, lime, or other suitable base (or a suitable combination of any of them) and water, in the form of a solution containing an excess of acid ; or a solution of sulphurous acid may be injected in sufficient quantity to produce a solution containing an excess of sulphurous acid above that required to form, in combination with the base, a mono-sulphite or normal sulphite. The valve is then closed and the contents of the boiler again raised to or above the boiling point of the solution, the valve in the boiler being kept closed during the whole time that it is necessary to continue the operation.

The operation of injecting sulphurous acid or its combinations with potash, soda, magnesia, lime, or other suitable base and water, as above described, may be repeated from time to time during the boiling so as to fully maintain, and if necessary increase the strength and efficiency of the chemical solution employed.

According to this mode of treatment a saving of the chemical employed is effected, little or no sulphurous acid gas being lost during the time the gaseous hydrocarbons and other gaseous or volatile matters are being driven out of the fibrous materials. And further, by first treating the fibrous substances with a mono-sulphite, the fibres will become impregnated with the same, and thereby protected from any detrimental action that might otherwise occur during their first boiling for the purpose of driving out the air, volatile hydrocarbons, and other gaseous or volatile matter by heat.

Instead of boiling the fibrous substances in the mono-sulphite they may be soaked in a cold solution of the same, and then steamed, and the air, free hydrocarbons, and other gaseous or volatile matters, allowed to escape through the valve with which the boiler is provided, previous to their treatment with the acid solution.

In the case where he employs an open vessel or boiler the operation will be naturally carried on at the temperature of the boiling point of the solution employed, but the process, and also the mode of keeping the acid solution at a fairly uniform strength, or, if necessary, increasing the strength thereof, will be substantially the same as that above described when using a closed vessel or boiler, in which latter case the operation may be carried on either at or above the boiling point of the solution. When using an open boiler it is evident that the excess of sulphurous acid supplied during the boiling will be constantly given on in a gaseous state from the surface of the liquid, and must consequently be replaced by further injections, while the acid given off can be led away and condensed, so as to enable it to be again used if desired.

In cases where the vegetable substances are boiled with water in conjunction with potash, soda, magnesia, lime, or other suitable base in the form of an oxide, the injection of sulphurous acid or its combinations with potash, soda, magnesia, lime, or other suitable base and water, during the boiling, but after the air and volatile hydrocarbons have been allowed to escape, will also be beneficial.

Mr. Graham prefers to inject the sulphurous acid, or the combinations of the same, as above described, into the vessel or boiler at the bottom, and to cause it to come in contact with the solution therein before reaching the fibrous material, for which purpose he forms a kind of chamber beneath the boiler, and separated therefrom by a perforated disc or diaphragm of lead or other suitable material capable of resisting the action of the solution, so as to allow the latter to fill the chamber. To this chamber a pipe is connected through which the sulphurous acid or a combination of the same with a suitable base, as described, is forced or injected by any suitable apparatus.

It will be necessary to coat the interior of the vessel or boiler, and the parts with which the sulpurous acid (or its combinations described) come in contact, with lead or other suitable metal or material capable of resisting the action of the same.

1st—Mr. Graham's claim, therefore, is the treatment of vegetable substances capable of producing fibres suitable for spinning, paper-making, and other purposes, either in a closed or open vessel or boiler, first with the normal or monosulphite of potash, soda, magnesia, lime, or other suitable base (or a suitable combination of any of them) and water, and when the gases contained in the vegetable substances have been driven off by heat and allowed to escape from the vessel or boiler, injecting into the said vessel or boiler sulphurous acid in the gaseous or liquid state, either alone, or in combination with potash, soda, magnesia, lime, or other suitable base (or a suitable combination of any of them) and water, or a solution of sulphurous acid, so as to form in the boiler a solution containing an excess of sulphurous acid above that required to form in combination with the base a mono-sulphite, and then subsequently boiling or heating the same, all substantially as herein described.

2nd—The injection of sulphurous acid, either alone or in combination with potash, soda, magnesia, lime, or other suitable base (or a suitable combination of any of them) and water, in the form of a solution containing an excess of acid, into a closed or open vessel or boiler, during the operation of boiling vegetable substances in order to produce fibres suitable for spinning, paper-making and other purposes, by treating them with water in conjunction with potash, soda, magnesia, lime, or other suitable base, in the form of an oxide or a mono-sulphite (called also a normal sulphite) thereof, such injection being effected after the gases contained in the vegetable substances have been driven off by heat, and allowed to escape from the vessel or boiler, and subsequently boiling or heating the same, all substantial herein described.—*Paper-Makers' Journal.*

THE BREAD-FRUIT TREE (*ARTOCARPUS INCISA*, LINN.).

WHILE there seems a sort of mania abroad at present for raking up, and discussing all sorts of plants producing valuable or imaginary products, reminding us of the old herbalists, there are several useful plants which seem to be neglected, and, as far as Ceylon is concerned, we may instance the bread-fruit tree, introduced to the island early in this century, and of which we have only one variety, and that a very inferior one, bearing only once or twice a year. No attempt has yet been made by Government or private individuals to introduce better varieties, several of which are known to exist in the South Sea Islands, unless it be the Hon. F. M. Mackwood, whose attempt to introduce good varieties failed in consequence of the plants having died on their way to Ceylon, from want of a proper mode of sending them, no doubt. The failure of the unfortunate Captain Bligh's first attempt to introduce the bread-fruit tree from the South Seas to the West Indies, in the " Bounty," is well-known, but in January 1793 he arrived in the West Indies in His Majesty's ship *Providence* having on board bread-fruit trees, and a vast number of other choice and curious plants. The bread-fruit of Dampier, Anson, Cook, Allis and others, which is a native of the Moluccas and the South Sea Islands, is likely to have been introduced to Ceylon by the Portuguese or Dutch before 1793, and is known to the natives as the *rata* (foreign) *del.* A close ally of the real bread-fruit, the *del. Artocarpus nobilis*, Thw., and one with a small fruit the *Artocarpus Lakoocha*, Rox., are natives of Ceylon, whilst the jak-tree, *Artocarpus integrifolia*, Linn., is a doubtful native.

When the Rev. W. Ellis, the accomplished author of *Polynesian Researches*, visited Ceylon in 1854 or 1855 he mentioned the fact that we had only one variety of the foreign bread-fruit tree in the island, and that a very inferior one : this fact was mentioned by Mr. W. Ferguson in his foot-note to Cameron's *Gardening in Ceylon*, in Ferguson's *Ceylon Directory* for 1863, p. 218, and has several times been alluded to in these pages since, and though they seem to have in the South Seas many varieties of the bread-fruit with large and small fruits, and of several qualities, some of them in fruit at all seasons, just as we have varieties of the mangoes in Ceylon, nevertheless, here we are in 1883 without any regular attempt except the one referred to, to introduce better varieties of the bread-fruit into Ceylon. The late Mr. Dyke, Government Agent of the Northern Province, for many years kept getting supplies of plants from the Western Province to be distributed in Jaffna of this valuable vegetable. Our Ceylon variety bears no seeds, but in the South Seas and West Indies, they seem to have seed-bearing ones called *Nucifera* or bread-nut tree, and seedless ones, *Apyrena* or bread-fruit tree.

In addition to the extracts we give from Bennett's *Gatherings of a Naturalist*, who gives a list of no less than 24 varieties of the

bread-fruit, and Horne's *Fiji*, we would refer our readers for further information to Ellis's *Polynesian Researches*, vol. 1, pp. 39-43, Williams's *Enterprise in the South Sea Islands*, pp. 421-23, for most interesting facts on the different kinds and uses of the bread-fruit tree. We extract as follows :—

Next to the above-mentioned food-plants, comes the bread-fruit (*Artocarpus incisa*), which is a most useful as well as a highly ornamental tree. It sometimes attains a height of 50 feet, but the average is from 30 to 40 feet. In general its trunk will measure about 15 feet to the first branches, with a girth of 3 to 4 feet. It is a horizontal branching tree, with a cone-shaped head. The leaves of the young trees are sometimes 2 feet in length, and from 12 to 15 inches in width. Those of the older trees are little more than half that size. They are covered with rough hairs, which makes them disagreeable to the touch. Some of the varieties have leaves deeply lobed, and those of some others are almost entire. The fruit of some of these varieties weigh as much as 9 lbs. ; that of others does not exceed 1 or 2 lbs., and 4 or 5 pounds may be reckoned the average weight throughout the group. They are in general cone-shaped, flattened at the base, or spheroid. The quality of some of them is excellent, dry and mealy like a potato ; that of others is watery and insipid. They are either baked or boiled, and eaten alone, or with pork or fish. Sometimes they are made into puddings, or buried underground, and made into a *Mandrai* *i.e.*, native bread. At all periods of the year there are some of the varieties in fruit, but the fruit is most abundant from the middle of February to the middle of April. In some of the native towns the trees are abundant, and groups of 29 or more, may frequently be seen scattered over land which had been cultivated. Large numbers of trees were destroyed in the wars that constantly occurred between different tribes,—the first acts of an invading force being to destroy food-plants and fruit-bearing trees of the tribe invaded.

One or more of the varieties of the bread-fruit bear seeds, but the most of them are barren. It is doubtful whether these seed-bearing trees are varieties of the *Artocarpus incisa*, or if they do not form another species of the same genus. The wood of the bread-fruit is used for some purposes by the Fijians, but it is not so good as that of "Jack" (*Artocarpus integrifolia*) or the *artocarpus hirsuta*. It is soft, light brown, with parallel veins of a reddish colour. When wounded, the trees yield a large quantity of white sticky juice, which is used for caulking the seams of canoes. The tree is propagated by suckers attached to a portion of the root from which the sucker has sprung. The young trees grow rapidly, and in the third or fourth year, after planting, they reach a height of about 16 feet, and begin to bear fruit. They have a picturesque appearance peculiar to themselves, of which a minute description would convey a very indifferent idea.

The bread-fruit tree (*Artocarpus incisa*) is one of the valuable indigenous productions of the Island of Tahiti ; and as it bears at various periods in different parts of the island, the fruit can be procured during the whole year. There is also a variety with seeds, called by a distinct name which I have seen at Erromanga (New Hebrides group), and it is also found at the Navigators' and Marquesas Islands. The *Artocarpus* delights in rich, moist, and sheltered situations, and is not found on elevated lands. The general name for the bread-fruit tree is *Maiore*, there are twenty-four varieties.* A white viscid juice is collected by incisions from the trunk, which is an excellent substitute for pitch. This tree attains the height of from 50 to 60, and a circumference of 6 feet. The timber is excellent and durable, and is used by the natives for building their vessels, as well as for other purposes ; its colour is reddish-brown becoming darker with age ; the sap-wood is light yellow. Some of the native cloth (named *Hobun* and *Aaone*) is manufactured from the bark of this tree, after undergoing the same preparation as the bark of the Auté, or Paper Mulberry (*Broussonetia papyrifera*) : this latter plant is a shrub, from the inner bark of which the Polynesian islanders manufacture their primitive cloth : the Japanese are said to use it in the fabrication of paper.

* 1. *Paea.*—This is a mountain bread-fruit : the fruit is long, of a large size, and very rough or tuberculated.

2. *Rare.*—The fruit is round, with a bright epidermis.

3. *Maire.*—One of the best kinds : it is a large and round fruit, with rather a smooth skin, and the leaves are more divided than in any of the other varieties.

4. *Rautia.*	5. *Buero.*	6. *Raumae.*
7. *Aravei.*—A long fruit with smoth skin.		
8. *Pehi.*	9. *Peiahuri.*	10. *Tatara.*
11. *Piipiia.*	12. *Iofai.*	13. *Fenra.*
14. *Opiha.*	15. *Ofatia.*	16. *Roru.*
17. *Ouiri.*	18. *Otea.* —	

The fruits of these last-named eleven varieties are of large size.

19. *Pafara.*	20. *Afatu.*—Both these bear small and round fruit.
21. *Tao.*	22. *Pafai.* 23. *Auuanu.*
24. *Maiore maohi* (the common bread-fruit).—*Ceylon Observer.*	

FIBRE PLANTS OF INDIA.

(By J. W. Minchin of Ootacamund, Madras Presidency.)

THE cultivation and treatment of fibre plants in India has occupied the attention of the Society of Arts on several occasions. The great botanist, Dr. Forbes Royle, first suggested the importance of the fibre-producing plants of India in 1854 ; and Dr. Forbes Watson, in an exhaustive paper before the Society, in 1860, enumerated the most important varieties ; having, with the assistance of the Indian Government, collected specimens, and prepared plates representing them, which were published in the *Journal* of the Society (vol. viii, p. 448). Mr. Leonard Wray read a paper on Indian fibres in 1869, and it was again the subject of an article by Mr. P. L. Simmonds, in 1875.

Notwithstanding these frequent discussions and the thorough knowledge that has been obtained of the value of the different principal Indian fibres, and of their cultivation and production, there has been no great commercial movement in the export of these fibres, and this is due to the difficulty that has been encountered in the treatment ; the cost of preparing the fibre for market by the native method of hand-scraping being prohibitive, and no machines or process for the economical preparation on a large scale having, until lately, been introduced.

For the valuable fibres strength and brightness of colour are essential. The ordinary process of retting or fermentation in stagnant water cannot be followed.

The *corchorus*, or jute fibre, is used principally for coarse bags, and such purposes where the strength and colour of the fibre is not important. It can be produced at a very cheap cost ; the cultivation of an acre of jute is estimated at Rs. 16 for the labour, and about half-a-ton of fibre is the usual crop ; while by the retting process, one man can prepare for market about two cwt. of fibre in the day. The cultivation of jute has been taken up largely by the natives in India. The export stated by Dr. Forbes Watson in his tables, in 1860, at 88,000,000 lbs., had amounted in 1874 to 560,000,000, or seven-fold, in the fourteen years. For the more valuable fibres this retting process is not available ; a man can prepare only 5 lbs. to 12 lbs. of rhea or Manilla hemp fibre in a day by hand-scraping, while the waste is enormous.

The necessity for some mechanical treatment has been long recognised. In 1872, the Government of India offered a reward of £5,000 for any machine that could separate rhea fibre in a green state, at a cost not exceeding £15 per ton. The conditions were not fulfilled, but a reward of £1,500 was given to Messrs. Greig, for relatively good results. The reward has since been withdrawn. The cultivation of rhea has now been successfully introduced into the South of France, Algeria, and the Southern States of America ; and the attention of scientific men to some chemical or mechanical treatment has been continued.

There are now two machines and two processes that claim to treat green fibre successfully. This being accomplished, the golden hopes of Dr. Forbes Royle and of Dr. Forbes Watson, as to the future of Indian fibre, may be realised.

As the soil and climate of the hill districts of Southern India and Ceylon, with which I have been connected for the past twenty-five years, seem to me to be specially adapted to the cultivation of fibre plants, and as the introduction of any new industry is at the present time urgently wanted by the European planters settled in those portions of our Eastern Empire, I have ventured to bring the subject forward again, for the purpose of urging the adaptability of this cultivation to the circumstances of the hill planters ; and the fact that lately invented chemical and mechanical processes have supplied the economical and commercial prospects of success which have so long been desired.

The following fibre plants are suitable for cultivation in the hill districts of Southern India :—Rhea (*Urtica utilis*) Neilgherry nettle (*Urtica heterophylla*)—these are dicotyledons, or exogenous plants, the fibres residing in their bark or bast—plantain (*Musa paradisiaca*), wild plantain ; Manilla hemp (*Musa textilia*,) aloe (*Agave Americana*), pine-apple (*Bromelia ananas*), wild pine-apple (*Bromelia sylvestris*), mooga, or bow-string hemp (*Sansevicra zeylanica*), mudar (or *Calatropis gigantea*)—which are monocotyledons or endogenous plants, the fibres being embedded in the pulp of their roots, stems, and leaves. These, and other kindred plants are indigenous to India, and can be cultivated without difficulty.

Rhea (*Urtica utilis*), *Boehmeria nivea remia*—China grass—is a perennial plant In China, fields of rhea are said to last, with care and manure, for 80 to 100 years. It grows in Sikkim and Nepaul at an altitude of 3,000 feet. It has been cultivated successfully on many coffee estates in India and Ceylon ; but it requires rich unexhausted soil. It grows with the greatest vigour in damp warm climates. In the islands of the Indian Archipelago it is cultivated under shade. It requires a light but fertile soil, but it must be well drained. It is propagated from the separated roots, from layers, slips, or cuttings ; in this way five cuttings of grown stems can be expected in the year after planting ; from seed no crop can be expected before the third year.

M. Favier describes the plant as giving out several stems, of which the number increases in proportion to the development of the root, which forms a kind of tuft or bush. The stems are woody, and have the appearance of thick strong rods, the highest varying from 5 to 12 feet. The roots, slips, or layers should be planted 18 inches apart, and after the first crop the alternate rows should be transplanted into new fields, leaving the remainder, about 3,500 plants per acre, to spread and cover the ground. The yield in Java is said to be 44 stems per year from each stool, taken in four cuttings. Each stem in its green state weighs about 1 lb. ; 100 lbs. weight of green stems yields 5 lbs. of a raw fibre or filament, which by Muspratt's analysis, as quoted by M. Favier, contains 66 per cent of pure cellulose. In the official reports to the India Office, with native hand treatment, the crop is said to be 1,000 lbs. of raw fibre per acre, taken in four cuttings. M. Favier states that, in Algeria, 1,400 lbs. of fibrous thongs was the crop per acre, as calculated by Mr. Hardy, ex-Director of the Botanical Gardens there, while in the South of France as much as 1,800 lbs. of filament have been obtained to the acre.

Mr. P. L. Simmonds, in his article in 1873 (*Journal*, vol. xxi, p. 762), stated that the crop gathered in Jamaica amounted to 300 lbs. per acre at each cutting, and that there had been five cuttings in the year, making the yield three-fourths of a ton per acre per year. While Mr. Bainbridge, in the discussion on Mr.

L. Wray's paper, in 1869, stated that the result of his own experience in Assam was 750 lbs. green nettles, which gave 45 lbs. weight of fibre in each of three cuttings, making only 135 lbs. per acre per year (*Journal*, vol. xix., p. 453). The yield appears to depend on soil, climate, and treatment. The properties of the rhea fibre place it in the first position among vegetable fibres; it is second to none in strength, while the fineness or attenuation of the fibre places it before flax, and it is equalled only by the pine-apple fibre. It can be used for any textile purpose, having been mixed with cotton, wool, and silk, to advantage; it is in special demand for sailcloth, table napery, curtains and tapestry; but from the very limited supply as yet available, the applications of this beautiful fibre are yet in their infancy.

Neilgherry nettle (*Urtica heterophylla*) is an annual, and can be readily grown from seed, giving its crop in about seven months. It gives a strong white glossy fibre, and a sample, hand-cleaned, was valued at £125 per ton. The cultivation has not been tried on a commercial scale: the difficulty will be in the cultivation and collection of the crop, as the leaves and stems are armed with a most poisonous sting. It has occupied the attention of planters on the hills for many years past, but no means of treatment was known.

Plantain (*Musa paradisiaca*) is generally cultivated for its fruit; it should be planted about six feet apart, and each stem will give about 4 lbs. of raw fibre, and 50 lbs. of fruit per year. The fibre is fine, white, and silky; long, light, and strong. The quality depends on the mode of cultivation and treatment; but it is not so valuable as Manilla hemp. The Government of India have constantly urged the value of this material for paper-making; but no use has ever been made of the millions of trees grown in India for their fruit. The stems are cut down, and left after the fruit is moved.

Manilla hemp (*Musa sylvestris*) has been successfully grown in Wynaad and other hill districts, since 1864; but hitherto to no commercial value, from inability to treat the fibre. It is grown extensively in Manilla, where 250,000 acres are planted with this staple; it has hitherto been treated only by hand, the natives preparing about 12 lbs. weight of fibre per day, and receiving one-half its value for the work, the waste being so great that only about 1 lb. of fibre is obtained from each tree. Yet notwithstanding this, the exports have amounted to 35,000 tons annually. Manilla hemp is imported into Europe and America for rope-making only, and is worth £20 to £60 per ton, according to quality; the crop may be taken at from 10 cwt. to 2 tons per acre, according to successful treatment.

Aloe (*Agave Americana*) will thrive on any sterile waste land, and is now common throughout India. The cultivation is being extensively carried on in Mexico, where 5,000 plants may be found in an acre. It comes to full growth in three years, and can easily be propagated from suckers. The fibre is principally used for mixture with Manilla hemp in the manufacture of cordage, and is worth about £10 per ton less than Manilla hemp.

Pine-apple (*Bromelia ananas* and *Bromelia sylvestris*) produce a very valuable fibre. The former is cultivated for its fruit in all coffee estates, and the latter is found in large quantities in all the jungle swamps in the hill districts. The fibre is valued at £45 to £55 per ton.

Bow-string hemp (*Sansviera zeylanica*) can be propagated on almost any soil, from the slips which issue in great abundance from the roots; it is perennial; the wild leaves are from 12 to 16 inches long, but under cultivation attain 3 to 4 feet. Dr. Roxburgh estimated that an acre of land would produce three-fourths of a ton of clean fibre.

Mudar tam. zercum (*Calotropis gigantea*) is common on all waste places in India. Mr. G. W. Strettel, of the Indian Forest Department, in his pamphlet, "A New Source of Revenue for India," published in 1878, urges the value of this product on the attention of the Indian Government. It comes to maturity in a year, is perennial, and requires no care. Mr. Strettel estimates the cost of bringing an acre into cultivation, planting four feet apart, at £2 9s. 8d., after which the only recurring expense would be for harvesting and treatment. He estimates that it will yield a crop of from five to seven hundredweight per acre yearly, and the fibre is pronounced equal to good flax, and therefore worth £40 to 50 per ton.

The treatment of green fibre has now been successfully accomplished by the following machines and processes:—

The machine of Messrs. Death and Ellwood, of which over one thousand are now in use, for extracting fibre from all kinds of aloe, plantain, and pine-apple, &c., in Mauritius, Canary Islands, Africa, &c. It is almost the only machine in use for extracting Henquin fibre or Sisal hemp, and Ixtle or wild pine-apple fibre, in Central America, of which 17,000,000 lbs. weight are now exported annually. It is being tried in Manilla for the treatment of Manilla hemp. The jet of water which acts as an elastic cushion on which the fibre is beaten, to clear it of boon and useless particles, acting also most satisfactorily in removing the gummy matter which causes the principal difficulty in the treatment.

2. An ingenious invention of M. Roquet, a Frenchman, for crushing and scutching vegetable fibres at one operation, which has been patented by Mr. W. M. Adams in this country and elsewhere. It treats all kinds of dry fibres most thoroughly, and has also successfully treated green rhea fibre from Kew Gardens.

3. M. Favier, a Frenchman, has suggested a process of treatment for rhea fibre, by steaming the green stems in the field. This enables the easy decortication of the bast by cheap hand labour, at a very small expense, and saves the cost of carriage of the woody portion of the stems, these being used for the fuel of the boiler that creates the steam. The stem ashes can be at once returned to the field as manure, together with the leaves and waste, so that only the fibre itself is removed from the soil; by this process it is calculated that the fibre thongs can be obtained at a cost of 30s. per ton.

4. The process which is known as Ekman's patent, for the manufacture of cellulose or ultimate fibre from raw fibres, by treatment with the bisulphite of magnesia. This process consists in boiling the fibrous substance under a pressure of 90 lbs. of steam, in water containing sulphurous acid, in combination with sufficient magnesia to prevent the oxidation of the organic matter. This chemical treatment produces an ultimate fibre from the rhea plant, which is worth £168 per ton, or three times the value of the best cotton.

Seeing that it takes 100 lbs. of green rhea stems to make 5 lbs. of raw fibre or filament, worth at the rate of £45 per ton in the English market, M. Favier's steaming process, which saves the carriage of the woody portion further than the field in which it is grown, is an economical consideration of the highest importance.

This raw fibre or filament, after treatment in M. Ekman's boilers, is reduced from 5 lbs., worth at the rate of £45 per ton, to 3½ lbs. of ultimate fibre, worth £168 per ton. When this process is undertaken by the grower in India, as soon as possible after cutting and decortication in the field, the fibre is saved from the damage that is constantly going on from fermentation, as long as the tannic gum is attached to it; it being impossible thoroughly to dry the fibre while this gum remains. There is no trouble in at once drying and packing the ultimate fibre. The cost of carriage to the manufacturing market is reduced to a minimum, and the pure fibre is in no way damaged by pressure in packing under screw or hydraulic press. At the same time the cultivator obtains the full manufacturing value, which is otherwise intercepted by the mill men, who scutch, comb, and prepare the fibre for textile uses.

It seems that for dicotyledons, or exogenous plants, such as rhea and Neilgherry nettle, M. Favier's steaming process, in conjunction with M. Ekman's bi-sulphate of magnesia process, have attained the desired object, economical and thorough treatment.

For the monocotyledons, or endogenous plants, such as plantain, Manilla hemp, aloe, pine-apple, &c., the machines of Messrs. Death and Ellwood, or M. Roquet, are required. For the coarser fibre obtained from these plants, no further treatment is necessary; these coarser fibres are used for rope-making. The finer fibres, such as those obtained from the *Bromelias*, and the selected finer portions from other kinds, may be advantageously treated in M. Ekman's boilers; while from the waste and inferior stuffs a paper pulp may be obtained which will be an important item in the receipts of the estate. In the cultivation of the fibre plants I have enumerated, the planters in the hill districts of South India will have varieties suited to every exigency of their soil and climate. For their exhausted fields, which are no longer suited for the cultivation of coffee, cinchona, or tea, there is aloe, mudar or moorga available, which will flourish on the poorest and most exposed hill-sides. For their low-lying rich valleys, at elevations too low for coffee or cinchona, such as the lower slopes of the Ghats, the cultivation of rhea fibre can be carried on; on the level land, where ploughing is possible, the Neilgherry nettle can be sown to advantage. The undrained swamps can be planted with the *Bromelia sylvestris*, and the borders of the streams and steep forest hills can be cultivated with plantain and Manilla hemp.

The store houses and water-power generally found on the coffee estates that have been erected for the preparation of the coffee crops, and which are unused for nine months in the year, will supply the motive-power for the scutching machinery, and drying accommodation for the fibre. It is probable that the cost of Ekman's boiling and chemical process may be too considerable for each individual planter; but some convenient central factory established in each district, or on the coast, may enable the planters to obtain the benefit of this process, on the same principle as is now in use for the ultimate preparation of their coffee. It therefore seems that good hope is afforded that the cultivation of fibre plants may relieve the Indian and Ceylon coffee planters of much of the troubles that have befallen them, from the persistent attacks of the *Himeileia bastatrix*, or leaf disease.—*Journal of the Society of Arts.*

POULTRY-BREEDING—NATURAL AND ARTIFICIAL MEANS.

THE Asiatics, and also some other varieties, are sometimes troublesome in their disposition to sit. When they are so persistent in the matter, and it is desired to have them laying again, either of these two methods will be found efficacious: Put the hen in a box with a lath bottom—the laths not over an inch wide and two inches apart; the box a foot or more above the floor. Having no way of keeping her feet and breast warm, the feverish desire to sit is soon cooled off, and usually in three days she is ready again to be turned into the yard. Another remedy is to put the hen in a small pen, with no perches, and place with her a vigorous young cock, kept by himself for this purpose. Two or three days will usually effect the desired result.

Where the hens are to do the hatching, they need to be removed to the sitting-room. This should be done at night. Have the nest ready, with half a dozen nest eggs, and fixed with a cover. After dark, take the hen in a basket to the room, and gently place her on the nest, covering or shutting her in. Do not open the nest again until the next evening, then let her out, and give her food and water; after fifteen or twenty minutes, if she does not go on the nest herself, catch her and put her on, again shutting her in. This may need to be repeated three or four days, but usually, unless the hen is nervous and wild, she will take to her nest of her own accord after the second day. When she does, then give her her eggs.

The French use turkeys for hatching, and in some places on quite a large scale. In some sections there are men who follow it as a business—hatching out chickens for the neighbouring farmers at "*so much*" apiece, or buying the eggs and selling the chickens as soon as old enough. One person in the vicinity of Lyons is said to have sixty turkeys sitting in the hatching season. Some years since I tried this method myself. It is not necessary that the turkeys should be broody; when wanted, they were caught, given a wineglassful of spirits, and placed on the nest with some dummy eggs under them. When they come out of their "drunk" they either imagine that they have legitimately begun their new business, or were so ashamed of their spree, rather than show themselves to their mates they prefer to remain in seclusion. These turkeys are kept sitting from two to three months; as fast as the chicks hatch, they are taken from the nests and fresh eggs placed under the turkeys for another clutch. Twenty eggs is the usual clutch given an ordinary sized turkey.

This same system of re-setting may be profitably pursued with hens. Where sitters are scarce, a good, quiet hen may be made to bring out two, and frequently three clutches. Care, however, must be had to keep hens and nests scrupulously clean, and have them come off regularly once a day for feed and water. In one case, which was an experiment, I kept a hen setting for thirteen consecutive weeks, bringing off four clutches of chickens, and I did not find that she was any the worse for her long period of incubation.

Another saving of time and expense, for which we are indebted to the French, is the use of capons to take care of the chicks after hatching. The capons are placed in a room or pen, without any perches, a week or two before they are needed. This accustoms them to squat on the floor or ground instead of roosting. At night one of them is removed to a small coop, and as soon as he gets quiet a few chickens are placed under him. The next day others are given to him, and they frequently have the care of twenty-five to thirty chickens, which they hover and tend as carefully as their natural mother.

It is hardly necessary for me to refer to the practice of doubling up broods, and I will merely state that among those who raise poultry for market it is customary to sit several hens at the same time and give the whole hatch to one hen, re-setting the others. I have seen this done on the Metropolitan Hotel farm to a greater extent than I know of elsewhere. An old Scotchman and his wife had charge of the poultry there, giving their whole time to it. I have seen broods of sixty to eighty chickens with one hen in May and the warm months. Seventeen acres were here inclosed and devoted to poultry. The yearly product was about three thousand chickens, three hundred to five hundred turkeys, and nearly the latter number of ducks. The laying and breeding stock, as well as the growing chicks, were fed largely upon the scraps from the hotel-table, which were barreled and sent up twice each week.

Thus far we have treated this subject purely in its natural light, or rather as we pursue it unassisted by any mechanical appliances.

In treating it as followed by artificial means or methods, it is perhaps best to digress a few moments from the subject proper and consider briefly what the artificial methods are; for, strictly speaking, there are two methods of hatching artificially: One, in which the eggs are subjected to heat all around, above and below, *i. e.*, enveloped; and the other, to only a top or contact heat—the same as given by the hen. We might term the two systems in contra—distinction the first, an enveloping heat; the second, a top heat. This heat may be communicated by hot water, steam, or a current of hot air passing over or through the egg-chamber, or by imbedding in a manure pile; all seem to be efficacious—though in unequal degrees—provided the temperature is kept up. But it is here where the method of "*enveloping*" heat fails; my own experiments with this method—and which are corroborated by those of English experimenters—is, that the only temperature which will give good results is 104 degrees Fahrenheit, and this heat *must* be maintained steadily throughout the three weeks of incubation.

The difficulty of keeping such a uniform temperature in a climate like ours is manifest; except with the almost constant watchfulness of an attendant, it would be next to impossible.

With the other method—top heat by radiation—a daily variation of from two to three degrees is not injurious, provided the eggs are turned regularly, and properly handled. In fact, an occasional variation of even five degrees is not necessarily hurtful, though in the early stages of incubation it had best be avoided. I advise a daily variation of not over three degrees, except of course the lowering of the temperature while the eggs are being aired and turned.

This top, or contact, heat is the nearest imitation to the natural process. Take, for instance, the hen or fowl making her nest on the ground, the top of the eggs, when in contact with her breast, are kept at the required heat; while the bottoms of the eggs resting on the ground must be many degrees colder. So, also, with the nests of birds: the nest is open and admits almost free circulation of air to the bottom of the eggs, while the top is kept warm by the mother bird. Such being the case, is it but reasonable to suppose that the top-heat system should give better results than the placing of the eggs in a warm bath—as it were—which is the case in all methods or machines when the heat is applied under or around the eggs? My experiments in this direction have been frequent and exhaustive, and cost me many hundreds of eggs as well as disappointments; but I can only regard the experience as cheaply gained, now that I have obtained such a high degree of success.

When we consider the process of incubation, the reason for following natural methods are very plain. We cannot hope to improve upon her ways of creating and developing animal life, and our best way is to imitate her as closely as possible.

It is well known to most breeders, and probably to many of my hearers, that the germ or life-giving principle of the egg always floats on the top. Under the influence of the heat the arteries and veins expand and extend, following the outside of the white of the egg until they reach completely around the yolk. The extremities of these veins are very fine and delicate. Nature, in her wise provision for the best development of their growth insures the bottom of the egg, where these fine veins are, being kept rather colder than the top, the contact of the body of the mother-bird with her eggs heating the top of the eggs, and keeping that portion several degrees warmer than the bottom.

When, therefore, the heat is applied under, or all around, the egg, these minute veins, instead of growing, shrivel and dry up; the yolk sack, instead of being absorbed by the growing chick, dries fast to the shell, and about the fifteenth or sixteenth day the chick dies. Some may reach the twentieth day, and few may, and do sometimes, hatch out; but the percentage is so very small that it virtually amounts to a failure.

The next point to insure success is the turning of the eggs. The hen usually makes her nest slightly hollowing, and when sitting thrusts her feet below the eggs. At intervals she raises one foot, which motion causes all the eggs on that side to roll down a little toward the centre of the nest; then she raises the other, and the eggs on that side are moved. By this simple action the eggs are moved in position as well as turned; she will also, with her beak, move the eggs from the centre of the nest to the outside. Instinct, or nature, whichever you may choose to call it, teaches her that the eggs under her breast receive a greater degree of heat than those under her wings or on the outer edge of the nest; and that to succeed in her maternal efforts, she must give all the eggs in turn the benefit of the greater heat. In doing this the eggs are turned; and whether it is called turning the egg, or something else, the effect is the same. To test this matter I have several times carried eggs through the whole three weeks in the incubator without turning or moving them at all. Unless some accident interfered there were some which hatched—generally from thirty to to forty per cent.; others which pipped the shell, but had not strength enough to get out, and still others, dead, with the yolk sack not fully absorbed, and dried fast to the bottom of the shell. Of those which did hatch, most were weakly, and full one-half died before they were a week old. One lot which I turned twice a week did ten or fifteen per cent. better. Another, which was turned daily, hatched seventy per cent.; and a final test when I turned the eggs *twice* daily, I obtained fifty-eight strong healthy chickens out of sixty fertile eggs, and both the remaining eggs had fully developed chicks in them.

Hence I adopt the practice of turning twice daily—morning and night.

Further experiment—turning them three or four times a day—has not given any better than this.

We may now consider the practical application, or use of artificial incubators. Most persons, even among those who yearly have raised large numbers of poultry, have treated it as an amusement for the fancier or gentleman farmer who might perchance manage to hatch a few puny, sickly chicks at a sacrifice of dozens of eggs. That this has often been the case with incubators is but too true: but the great improvements of the past few years make such a result among the things that may only *possibly* occur by carelessness or negligence.

We have an incubator which, with fifteen minutes' attention, morning and evening, any intelligent person can certainly hatch from seventy-five to eighty-five per cent. of the fertile eggs.

It is unnecessary to assume what gain this would be over the natural way, for it is well known to every one who has had any experience in this line, that the average result among the farmers and breeders of poultry for market will not nearly reach that figure.

Take, for instance, one hundred eggs to be hatched in the natural way; these would require eight hens to cover. Of these eight, one would desert her nest before her brood was due, two more would each break one-third of their eggs, and the remainder average ten chicks to a sitting; or, say, a to total of sixty chicks from the one hundred eggs.

This, as many of you well know, is a *good* average result. It too frequently happens that the hen will become apparently in the condition of the herd of swine mentioned in the Holy Writ—possessed of devils—and conspire to break all the eggs they possibly can, and then leave all they could not break to chill and die.

I know of one such case, the past season, where a neighbour secured from eleven hens a single brood of eleven chickens—an unusual result, you say; but one such result cuts down the year's percentage far below my figures, and thus proves my assumption.

And now, to one summary of the two methods:

Assuming that we wish to turn out four hundred chickens per week for ten months of the year, which would give us about seventeen thousand in all. We would need for this three incubators of five hundred eggs' capacity each. Those of the pattern on exhibition at the poultry exhibition—the new Centennial—would cost one hundred dollars each. I would also add one of the small size, one hundred eggs' capacity, as an auxiliary, costing forty dollars, making the total cost of incubators three hundred and forty dollars.

You will please bear in mind that I am allowing for a loss of twenty per cent. of the eggs, which is fully five per cent. more than the average loss with this machine.

To keep these machines stocked with eggs to their full capacity will require five hundred per week. Taking the season *through* the average hen will not lay oftener than three days out of seven—hardly that; yet we will assume that as our average—hence, for every three eggs we, get we must keep seven hens. At this rate we shall need about 1,150 (actual number is 1,166) hens to keep the machines stocked, which, at fifty cents each (a very low figure, as you poultry-breeders all know) will cost $575.

Our outlay, therefore, so far amounts to $915.

Now, as to the number regarded by the natural method and the cost.

First, we must allow for a loss of forty per cent. of the eggs under this method. After twenty-five years' experience and observation, I feel satisfied that nine-tenths of our farmers will exceed that per cent. of loss rather than come below it.

We shall require, on the same rates as computed above, 1,540 hens for our laying stock alone to produce six hundred and sixty eggs weekly—the number required. To cover these, allowing thirteen eggs per hen, will require fifty hens per week for three weeks, one hundred and fifty in all. Now, allow that we double broods when hatched and re-set half the hens, and we must have twenty-five hens more for the fourth, fifth, and sixth weeks, and each succeeding week after.

Allow also six weeks as the time each hen runs with her brood, and then immediately commences to lay again. We are constantly losing with every hen a laying period of nine weeks out of the season, which, estimated at forty-two weeks, is three-fourteenths of her time.

To compensate for this we must add 330 more hens to our flock, making 1,870 in all, which, at fifty cents each, the same as above estimated, makes $935 as the outlay by the natural method as against $915 by the artificial, a clear gain of $20 in cash in favour of the latter, without taking into account the trouble of obtaining your sitters just when wanted.

As most of us know, when we have an abundance of eggs, we have few sitters, and when we have plenty of sitters, eggs are often scarce. With the use of incubators we have no difficulty from this source, our "*sitters*" being always ready.

Our next comparison is as to cost of hatching. First, we will consider the size of room required to cost the same in either case, although in reality the space required for one hundred and fifty sitting hens will be double or treble than needed for four incubators.

The nests for the hens, at a low estimate of ten cents each, will amount to fifteen dollars; straw or hay for the nests *for the season*, say, five dollars more; next food. It is computed that one dollar will keep a hen a year, *i. e.*, when she is running out and has access to worms, grubs, &c., which in this case she has not, and I do not think in that view of it that one dollar per head is too much to charge for the ten months; say, one hundred and fifty dollars for feed, plus twenty dollars for nests and litter, equals one hundred and seventy dollars. The matter of attendance is a difficult item to get at, and we will leave it for the present.

Now our machines will burn, say, ten gallons of oil per week; this is allowing three gallons for each of the larger machines and one gallon for the small machine. (I think this an over-estimate.) At sixteen cents per gallon, which is the average price in New York market, this will cost us for forty-two weeks, $67·20; wicks and *possibly* new burners, $4·80 more. Add also interest on the cost of our machines at six per cent. (seventeen dollars), and we have a total of eighty-nine dollars—call it ninety dollars even money, which, taken from one hundred and seventy dollars, leaves eighty dollars—a gain in favour of the machines.

Next comes the question of care or attendance, which we cannot estimate, although it is very evident that the care of one hundred and fifty hens must be double that of four incubators.

The next cost to be considered is the coops or brooders for the chicks. If we follow the artificial system exclusively, we shall need brooder accommodations for four hundred chicks weekly, which will cost us for three brooders. No. 4 size, four hundred chicks each complete, say, thirty-five dollars—one hundred and five dollars. To these we must add three summer mothers, at ten dollars each, making $135.

In coops, if we use hens as brooders, we shall need twenty-five each week for six weeks, making one hundred and fifty coops, allowing $1·25 (which is twenty-five cents less than I have ever been able to get them made for), and we have a cost for coops of $187·50—another balance of $52·50 in favour of the artificial method.

The cost of oil for the brooders will not be any more, and probably hardly as much as the food for the hens while cooped with the chickens.

We have thus far figured a clear gain of $152·50 in favour of the artificial method, giving the hens the benefit of the estimate in every case.

Next we must consider the great gain derived from the increased number of chickens raised under the artificial system over the natural one.

This is computed by breeders, who have tried both, to be fully ten per cent. Hatched artificially, the chicks are free from lice, for there is nothing from which they can be communicated. And as lice and mites are without doubt the cause either directly or indirectly of fully two-thirds of our poultry ailments, it follows that our young stock is healthier, more thrifty and growthy, and we are enabled to raise a much larger per cent. than with the hens.

Another gain, and one that commends itself to every breeder of poultry, whether for fancy or for the market, is the advantage of always being able to sit the eggs while they are fresh, whether it be in midwinter or midsummer.

This waiting for broody hens while your eggs are spoiling is a source of great annoyance as well as much pecuniary loss to the breeder, and should be a strong argument in favour of his adopting the artificial method.

Another advantage (which, while not a pecuniary one, is of great satisfaction to the fancier), is the resulting gentleness of the young stock. Even the natural timidity of the Leghorns and Hamburgs—the most shy of our domestic breeds—is overcome, and the chicks take food from the hand, and perch on the shoulder of the feeder, with an entire absence of fear. This has many advantages, which are quick to be appreciated, especially by ladies who have the care of chickens.

We estimate that to produce and rear a chicken by artificial means to eight weeks old, costs an average of fifteen cents each. This is in the vicinity of New York; in the West, where grain is cheaper, it will cost somewhat less.

I speak especially of this age—eight weeks—because it does not pay us in the East to raise them to adult age. At this age they are worth for broilers from fifty to seventy-five cents each; for every week over that age the cost is increasing at a much greater ratio, and the price is either stationary or decreased.—*Thoroughbred Stock Journal.*

MATE OR PARAGUAY TEA.*

THE following account of the Paraguay tea plant is taken from a translation published in the *Pharmaceutical Journal* of a paper by Dr. Theodore Peckolt in the *Zeitschrift d. allg. öster. Apot.-Verein.*:—

This plant, which belongs to the holly family (*Ilicineæ*), has several names in different parts of South America. In the Guarani language it is called *Caá*, which is the Indian word for leaf. The prepared leaves were named by the Spanish "yerba" (herb), and the infusion "mate" [unaccented] from the native name of the vessel in which the tea is made, and the drug is now generally known as mate in Brazilian commerce, although the Spaniards call it "yerva mate" or "yerva de palos." The name "congonha" has been said by some writers to be applied to mate, but this is an error, for the Brazilians understand by the names "congonha mansa" and "congonha brava," other trees belonging to the same natural order, which are used as a substitute for mate when it is not easily procurable.

The plant was first briefly described by St. Hilaire, in 1822, when he gave to it the name *Ilex paraguariensis*, which he altered in 1826, to *Ilex Mate*, subsequently publishing the first name again in 1833, and this is now adopted in the "Flora Brasiliensis." In 1824 the plant was described in detail by Lambert, under the name of *I. paraguensis*, and the plant illustrated from specimens from the Jesuit Missions. The synonyms stand as follow:—

Ilex paraguariensis, St. Hil.; *I. Mate*, St. Hil.; *I. paraguayensis*, Hooker fil.; *I. paraguensis*, D. Don.; *I. paraguariensis*, *a*, *obtusifolia*, Mart.; *B. acutifolia*, Mart.; *Cassine Gongonha*, Raben; *C. Gonguba*, Guibourt; *Chomelia amara*, Vell.

The mate plant attains the height of an apple tree, becoming even larger in favourable situations, but when cultivated and deprived from time to time of its leaves, it remains small and forms a more bush. The leaves are shortly stalked, simple, wedge-shaped, obovate or elongate-lanceolate, toothed, dark green above, paler beneath, shining, of leathery consistence, one to three inches long, one-eighth and to one-and-a-half inch broad. The flowers are axillary, situated on one to three times forked peduncles, white, and of similar size to those of the common holly. The calyx consists of four nearly orbicular sepals with a four-parted corolla and four short stamens, the ovary being crowned with a four-lobed stigma. The fruit is red, and of the size of a pepper-corn, containing four seeds enclosed in slightly glutinous pulp, but often one seed only is developed. The home of the Paraguay Tea Plant is said by Martius to lie between 18° and 30° S. latitude, but the district in which the tree grows most luxuriantly is between 21° and 24° S. latitude in the watershed of the Paraguay river on the west, and in that of the Panana river on the east, and it is here in a zone between the Serra Amambuhy on the South, and the Serra Marscajú on the north, that the best and most highly prized mate is prepared.

How long the South American Indians had been in the habit of using mate is not known, but when the Spaniards seized the provinces on the rivers Paraguay and Uruguay they found this custom prevailing there exactly as first mentioned in the writings of Azara, who stated that the tree grew wild in different parts of Paraguay. In proof of the high estimation in which it was held by the Indians, it may be mentioned that the name "caa," which signifies in the Tupi language a tree or plant, was given by way of distinction to mate, that being the tree valued above all others. The use of mate does not appear, however, to have extended to extra-tropical districts, but to have been confined to the more intelligent tribes known now under the name of Guarani Indians. Nevertheless, when these people were driven further north by Europeans, they do not appear to have carried the use of the drug with them, probably thinking it not worth while to obtain it from a distance and from a hostile people, when they found a substitute close at hand in the Guarana plant.

The extensive use of mate in South America at the present time is probably due in great measure to the Jesuits, who encouraged its use, finding that it restrained the desire of the Indians for spirituous drinks, while its cultivation, collection, and preparation gave employment to converted Indians, and brought wealth to the Order. In the Jesuit Republic, the Indians were not paid in money but in produce; 4lbs. of mate were allowed to each family.

After the expulsion of the Jesuits, the preparation of mate was continued in the Paraguay Republic under the administration of the Dictator Francia and his successors, until Dictator Solano Lopez was killed in battle with the Brazilians in 1870. An overseer was appointed over the work who also was paid in kind, receiving for each aroba of the tea, natural produce of the value of ¼ ounce of gold. Since 1870 there has been free trade in the article, which renders an increase of the trade very desirable. At the present time mate is used by about 12,000 of people, and the consumption amounts to about 8,000,000 pounds.

It has been stated that mate is not prepared solely from *I. paraguariensis*, St. Hil., but that the leaves of other species are mixed with it.

In 1842, Sir W. J. Hooker published, in the *London Journal of Botany* (vol. i., p. 30), an exhaustive account of the yerba mate, together with the characteristics of the different

varieties which he considered identical with *Ilex paraguariensis*. This paper strengthened the previous opinion of Miers that probably more than one species was used in the preparation of the tea. The investigations made by Miers and the monk Leandro, Director of the Botanical Gardens in Rio Janeiro, confirmed by Bonpland, indicate that six different species are used for the purpose:—(1) *Ilex theezans*, Bonpl., growing in Paraguay, Entre Rios, and Brazil; (2) *Ilex ovalifolia*, growing in the neighbourhood of Rio Pardo; (3) *Ilex amara*, Bonpl., on the mountains of Santa Cruz, and in the forests of the Brazilian province of Parana; (4) *Ilex crepitans*, Bonpl., in the interior of Santa Cruz, and the banks of the Parana river; (5) *Ilex gigantea*, Bonpl., on the banks of the Parana river. This is the "caá-una" of the Guarinis. (6) *Ilex Humboldtiana*, Bonpl., in the province of Rio Grande do Sul. This is the "caá-unina" of the Brazilians. The last four species, more especially *I. amara*, yield the "caá-chira" of the Guaranis and the "caa-una" of the Brazilians. Martius, however, in the "Flora of Brazil," states that in the central districts of Paraguay, where the *I. paraguariensis* is especially abundant, only the leaves of the species are used; in other districts the various species of *Ilex* are similarly employed.

It is certain, however, that *I. paraguariensis* is the only species in cultivation, but this is carried on to a very limited extent as the wild plant is still abundant. The Jesuits planted the tree because they found that under cultivation the leaves had a milder and more pleasant taste. For cultivation, the seeds are carefully freed by washing from the glutinous matter in which they are imbedded, without which treatment they would not germinate, this office being probably performed in a natural state by birds, since the Indians believe that the seeds will not germinate unless they have been voided by birds. The young plants are taken out of the hot-bed when about six inches high, and planted out about twelve or fourteen feet apart, in a damp, somewhat marshy ground, so as to allow of a small trench being made around the plants in which water can collect. They must also be grown under the trees which afford shade, as the young plants are easily killed by a strong sun. When they are about three to six feet high, some of the shade plants are removed, and in four years the leaf harvest can be begun. The young trees should not, however, be entirely deprived of their leaves, lest they should not be able to recover. In the seventh year they will yield thirty to forty kilos of leaves. It is calculated that on 220 square metres of land one thousand six hundred trees can be grown, yielding on an average thirty-five kilos of leaves per tree, or about 25,454 kilos of leaves, valued at 190,000 marks per 100 square metres. The cultivated plant remains a small bush, and never reaches the stature or size of the wild tree. The cultivation of mate has been carried out with much success in the province of Parana by Dr. E. Westphalen, and it promises to be successful in the Dutch colony of S. Leopoldo in the province of Rio Grande do Sul, where the plant grows luxuriantly.

The tree has been planted in the Cape of Good Hope, and seems to succeed well there, as well as in Spain and Portugal. The quality of Paraguay tea depends upon the time of year in which it is collected, the leaves possessing most aroma when the fruit is nearly ripe. In the Argentine Republic, and in the Brazilian province of Rio Grande do Sul, the leaves are collected from February to the end of July. The new shoots are put forth in August, but at that time it would ruin the trees to gather the leaves. In the forest of the Brazilian province of Parana and Santa Catherina, the harvest is collected from March to the end of September. In Paraguay it begins in December and continues till August. About a month beforehand the collectors set out in caravans with their wives and children into the forests where the mate trees are abundant, and make their encampment.

The first operation is to prepare a torrefier, which is made in the shape of an arbour. The twigs are cut off from the branches and slightly scorched by drawing them quickly across the fire. The twigs are then collected into bundles suspended over the torrefier a small fire of dried wood being kept alight beneath. In about two days the drying is completed, the ashes are removed, and in the spot where the fire was an ox-hide is spread out, on which the leaves are beaten from the twigs with a wooden blade. The dried leaves are then powdered and packed in wooden cases made of hollowed trunks of trees.

In the province of Parana the leaves have lately been dried in large wrought-iron pans, in the same manner as Chinese tea, or in specially constructed ovens in which they can be prepared so as to retain more aroma; they are then powdered by machinery and sifted; this kind of mate obtains a better price.

Another form in which the leaves are prepared is by carefully separating them from stalks and twigs and roasting them, but this is not so much esteemed as the powder except in Chili, where the leaves are prepared.

In the South American Republic and the Brazilian province of Rio Grande do Sul, mate is packed in serons of ox-hide holding thirty kilograms, and in half-serons, containing fifteen kilograms; this packing gives to the mate a disagreeable flavour, which detracts from its value.

In Parana it is packed in cane baskets; these are lined with dried grass, called Jacaes, and contain fifty to sixty kilograms. The mate in leaves is here sold at 280 to 290 reis (about fifty-six pence); powered mate is sold in thick and better-woven cane baskets, containing in a half-seron fifteen, and as a seron, sixty kilograms, the price being ten to twelve per cent more than the leaves.

In the Spanish Republic three different sorts are sold under the following names:—

1st.—Caá-cuy, or Caá-cuys; these are the new leaves of the scarcely developed shoots. They are of more delicate texture, and of a yellowish colour. They possess an agreeable and pleasant flavour, but are seldom met with in commerce.

2nd.—Caá-mirim.—This was the chief product in the time of the Jesuits, and consists of the leaves carefully separated from the twigs and stalks, the mid-rib of the leaf being also removed. This kind is chiefly esteemed in Peru, and principally exported there by the Brazilians. It is called herva manes.

3rd.—Caá guacu, Caá-una, or Yerva de Palos, is the most inferior kind, consisting of the large and old leaves with the twigs and fragments of wood, and possessing a strong and bitter flavour.

In Rio Janeiro, two sorts are known to commerce—mate in leaf and mate in powder. In order to test the quality of mate, the merchant takes a small quantity in his hand and blows upon it. If the greater portion is blown away, he considers that it has been heated too much, and thus deprived of its strength. If it is not easily blown away, it is then considered of good quality.

Mate has been the subject of several analyses. In 1836, Trommsdorff analysed mate and found tannin, two resins, extractive matter, and a substance which he believed to be an alkaloid, but he possessed too little material for complete investigation.

In 1843, Stenhouse found in mate an alkaloid, and proved that it was identical with caffein.

In 1850, Dr. Rochleder investigated Paraguay tea, and found the reactions of mate-tannic acid to be identical with those of coffee-tannic acid.

Lenoble, who, as well as Dr. Rochleder, supposed mate to be produced by *Psoralea glandulosa*, named the crystalline active principle he obtained from it, "psoralein." He also found in it wax, albumen, and volatile oil.

According to Dr. Byasson, mate contains as much caffein as the best Chinese tea. The variety which he experimented upon was caá-guacu. He found also a viscid substance resembling birdlime, soluble in ether; this he considered to be a fatty body of the nature of a compound ether, whose alcohol was allied to cholesterine.

Robin has examined several different kinds of mate. The amount of caffein in young leaves dried without special care was 0·02 to 0·03 per cent.

Mate prepared by the Indians, and containing twigs and fragments of fruit yielded 0·16 per cent, and mate from the mission of the province of Corrientes, 0·14 per cent. The peculiar tannic acid, which Dr. Byasson did not find, varies between 1 per cent and 1·6 per cent. The ash of young leaves varies from 0·12 to 0·2.

Professor A. W. Hofmann, of Berlin, found 0·3 per cent of caffein. The average of the published analyses indicates about ½ per cent of caffein, that of India tea being 2 per cent. The value of mate, as in the case of tea, depends not merely upon the caffein but also upon the tannin and aromatic principles. He considered the tannin to be identical in every respect with that found in tea.

The aromatic principle has not been isolated, but by dry distillation a volatile oil is obtained, which belongs to the phenol group and is soluble in alcohol.

In 1877 the mate-tannic acid was examined by Dr. Pedro N. Arata, who found that the tannin of mate, while analogous to that of coffee, was not identical. The chief differences noticed by him are as follows:—Lime water gives with the coffee-tannic acid a small precipitate soluble in excess, but an abundant insoluble precipitate with the tannin of mate. This, however, does not hold good with all samples of mate, the precipitate being sometimes soluble in an excess of the tannin. Coffee-tannic acid gives by dry distillation pyrocatechin, while the tannin of mate yields in addition to pyrocatechin the isomeric body resorcin.

Coffee-tannic acid is soluble in 52·84 vol. of alcohol, while mate-tannic acid requires 73·66 vol.

Dr. Arata considers that coffee-tannic acid may be regarded as dioxyparacinnamylic acid, whilst mate-tannic acid must be classed in the group of oxyphenylpropionic acid.

Soubeiran and Delondre state that mate contains the same essential constituents as the coffee leaf, and in greater amount than the coffee seeds, which Dr. Peckott confirms after numerous experiments with large and small quantities.

KAING GRASS FOR PAPER-MAKING.

THE following communication on this subject from Mr. Henry Buckle, the Deputy Commissioner in British Burmah, has been addressed to the Editor of the Paper-Makers' Monthly Journal.

SIR,—I have lately read a letter from Mr. Listard, on the above subject, at page 352 of your Journal of 15th December last, and I think a further account from me may be acceptable.

Kaing grass, or, as it is sometimes called, "elephant grass," is a kind of reed which grows wild all over the southern portion of British Burmah. It reaches to a height of 12 to 15 feet, and growing luxuriantly in places where nothing else will flourish, there is little probability of the supply ever failing.

Under the orders of the Government of British Burmah, I have carried out three experiments with this grass, in order to decide the question whether it can be utilised for paper-making.

I should first note, that while convict labour was utilised in the vicinity of the jail, the grass had to be cut by free labour, since, if the convicts had been sent out, they might have taken the opportunity to escape.

The grass was cut down close to the ground, and carried in bundles to the jail. Inside the jail, convicts cut off the tops of the grass, where the cane ceases, and the tops were discarded. The

canes were then stripped of the outer portion of barks and were generally cleaned. After being passed through a crushing mill they were cut into short lengths, the joints being thrown away. This was done because the fibre was found to be weakest at the joints.

The short lengths of cane, which were some ten inches long, were then carried outside the jail, and thrown into large wooden tubs, which were placed on a raft anchored in the river, on which a gang of convicts were working.

The convicts sat on the raft, each man having a block of wood in front of him, and was provided with a wooden mallet. A handful of canes was taken out of one of the tubs, was beaten on the block, and, being constantly immersed in water, the pithy matter was gradually got rid of.

The whole of the day's supply of the raw material having been thus treated, the tubs were filled with fresh water, and the stock—as I shall now call it—was left to soak all night.

In the morning this stock was first beaten once more and rinsed, and was then placed on a raised, open bamboo platform, for the water to drain off and for the fibre to dry. It was found that in drying the sun bleached it almost white. The stock was then stored in a shed to finish drying and to be packed. Under date 18th January 1882, the Bally Paper Mills reported as follows on a consignment of 3,690 lbs. of paper stock prepared in the way described:—

"This (45 maunds of stock) we boiled with caustic soda at 20 per cent, and bleached with bleaching powder at 15 per cent. The sample of the paper sent will show a fair result for a first trial. The colour does not come up particularly good. This may be improved. Under-boiling may have affected the colour. The stuff is very easily treated, washing freely. We have not been able to ascertain the loss in weight, but it is considerable."

Under dates 18th and 24th August 1882, the Bally Paper Mills reported as follows on a consignment of 400 lbs. of paper stock prepared as before:—

"The five bales were placed in the boilers without any previous cleaning, and boiled with 20 per cent of caustic soda for 10 hours. The boiling was next bleached with a solution of 15 per cent bleaching powder, after which it was passed through the breakers and beaters in the usual way, and finally on to the paper machine, over which it ran very nicely and cleanly.

"The trial was made under great disadvantages, owing chiefly to the very small quantity of material to be experimented with, and also to the fact that during the monsoon it is very difficult to obtain really clean water, so that the colour is not so good as might certainly be expected with clean water such as is obtainable from October to June.

"There is no doubt that this material is very suitable for paper, being easily wrought, and showing, as far as could be judged by this trial, that the loss in weight is less than that of any other grass experimented upon by the Bally Mills. The paper, too, is strong and clean, and shows an excellent surface.

"*Colour.*—We have not the slightest doubt that the material can be bleached up to a good white, and so be capable of taking any tinge desired.

"*Strength* is most satisfactory, and is great enough for almost any uses to which paper can be put, except for bank-notes and such-like.

"On the whole we are very pleased with the success of this trial, and feel convinced that if the material can be produced at a reasonable rate and in large quantities, it will soon make a name as a paper-making material.

"We should think an arrangement of fluted and plain rollers, with a free supply of water, driven either by water, steam, or manual power, would greatly tend to reduce the cost of cleaning."

Under date January, 1883, the Bally Paper Mills reported on a consignment of 50 baskets of the paper stock, containing over 3,000 lbs., which had been prepared in the same manner and with exactly the same care as the two former consignments. The words of the report are not quoted because they are contradictory, and because, less chemicals having been used—a solution of only 18 per cent caustic soda and 13 per cent bleaching powder—the unsatisfactory result is not conclusive.

Under date January, 1883, I received a report from a gentleman in England to whom I had sent a small quantity of the paper stock, prepared as described, and he said that he had experimented with my material and some esparto grass, and that, having used the same quantity of chemicals with each, mine was "the stronger of the two, and it certainly shows whiter."

Under date 23rd January, 1883, I received a report from a gentleman in Scotland, to whom about 70 lbs. of the paper stock, prepared as described, had been sent, and he wrote as follows:—

"As regards the respective advantage of kaing and esparto, there is no doubt that kaing makes a stronger paper than esparto, and that it also bleaches better. But it cannot be picked and cleaned so well as esparto.

"There is a kind of black bask, which is hardly noticeable before boiling and which will not bleach, which seemed to be present in considerable quantity in the sample tested. If this could be got rid of, kaing would be quite as clean as esparto.

"Another objection to kaing is that it is more bulky than esparto, not in the bales, but in the boilers: it swells up more than esparto and so much cannot be put in. The same applies to the breakers, potchers, and beaters, perhaps more at the beaters than elsewhere, as, while it takes a certain time and a certain amount of power to beat an engine containing a given weight of esparto, it takes the same time and the same amount of power to beat about two-thirds of the weight of kaing."

It will be noticed that all the reports agree in saying that the paper made from kaing grass is very strong, stronger than paper made from esparto grass.

As regards the colour, too, the reports are very favourable.

The black basks noticed by the gentleman in Scotland were also mentioned in the third report from Bally, but they were not very noticeable in the sample of the paper made which I received from Bally. No really fair table can be drawn up of the cost of the preparation of this paper stock, as convict labour was employed, and extra warders had to be engaged to look after the convicts working on the raft.

During four months I employed on an average 22 convicts a day, some inside the jail, and some on the raft. I worked up 47,136 lbs. of the canes, as cut and with the tops on them, which cost 48 rupees (£4 16s.), into 6,761 lbs. prepared and dried paper stock.

The cost, therefore, of enough canes to make 140 lbs. of prepared and dried paper stock was 1 rupee.

With the 22 convicts I turned out each day about 70 lbs. of prepared and dried paper stock, so that 140 lbs. would represent about the outturn of two days' work of 22 convicts.

Following the usual calculation that one free man will do the work of two convicts, the cost of the preparation of 140 lbs. of prepared and dried paper stock would be somewhat as follows:—

	Rs.		
Cost of sufficient canes to make 140 lbs. of prepared and dried paper stock	1	0	0
Hire of 11 free labourers for two days, at 8 annas each per day	11	0	0
Rupees	12	0	0

The cost, therefore, of 100 lbs. of prepared and dried paper stock would be Rs. 8 : 9 : 1, or 17*s.* 1*d.*

Knowing that esparto grass is shipped to England in its raw state, an experiment has been made in sending thither a considerable quantity of kaing grass tied up in bundles as cut. I have not seen any report of the result, but I have heard that the grass was found to have become quite brittle on its arrival in England, and to be quite useless.

If this material is to be brought into use for paper-making, some labour-saving machinery must be adopted to reduce the heavy cost of hand labour. It might perhaps be possible to utilise the splendid water power which is at hand in Burmah, or, if that is not possible, steam might be used, and there is at last good reason for hoping that a valuable coal deposit has been discovered only a few miles from the banks of the Irrawaddy river.

To anyone proposing to commence the preparation of paper stock from kaing grass on a large scale, I would suggest a site in the district of Thonegwa in British Burmah, where kaing grass is to be found growing wild over large areas.

An arrangement might gradually be come to with the villagers to deliver the canes at the mill at a certain price. The canes might then be cut into lengths, discarding the joints by machinery, and then I believe the ordinary breakers and beaters would remove the pith and leave the pure fibre, which could be dried, pressed, and packed in bales for shipment.

Yours faithfully,
HENRY BUCKLE,
Deputy Commissioner, British Burmah.

IMPROVING FLOCKS.

THE merchant is constantly trying to improve his trade by improving the quality of his goods without increasing the price in proportion, trying to meet all the wants of his customers. The manufacturer tries to increase the amount of his sales and profits by improving the character of his manufactures: so, likewise, should the flock owner make it a constant study how to improve the character of his flock, both as to its capacity for increasing the weight of carcass and wool from a given amount of food, and its capacity for breeding strong, healthy lambs. Every element of income should be taken into consideration, and an effort made to increase the value of each.

The best digestion produces the best growth of body from a given amount of food, and the power of digestion is increased in several ways. First by the proper selection of foods. A mixture of grasses is nature's prescription of food for the sheep, as well as other grass-eating animals. This mixture of grasses contains all the elements, in precisely the right proportion, and when in full supply, cannot be improved upon. When other food must be given it should be of a varied character, in imitation of the grasses. The sheep has a strong craving for variety in food, and should be indulged. It is always a strong recommendation of a food that it is palatable—that the animal eats it with pleasure. This is an element of digestibility. Second, *habitual full supply of food increases the power of digestion. The full supply of food gives* full exercise to the stomach, and its power is increased by this exercise. The blacksmith's arm grows more muscular by the constant exercise of wielding the sledge-hammer; so the animal full-fed from birth acquires a large increase of digestion, and grows with great rapidity to its full maturity. It is this increase in the power of digestion that enables the animal to come full weight in half the usual time of slow growth. Food enough must be digested to make this growth in this short time; and this is the real improvement in the vital machinery of the improved animal.

Let us examine the effect of small and large digestion on the form of animals. If we note the bodies of the sheep kept upon barren hills, or where food is scanty, we find them long, thin-bodied, sharp-backed, long-necked, long-headed, and long-legged. This is the way nature moulds her forms on a meagre diet and slow digestion. An expert animal anatomist could at once tell the liberality of the diet of the animal by an examination of its skeleton. But if we examine the improved sheep of any breed, we find them compact, round-bodied, broad-backed, short-legged animals, rounded out into lines of grace and beauty by superior alimentation,

This improvement might have been very much hastened by selection in breeding, but still, the basis of the improved forms has been skilful feeding, long continued. This increased power of digestion comes of long habit. An animal that has always had scanty food has a very limited digestion, and it cannot suddenly be much increased. The food must be increased very gradually, and the stomach increase as gradually in its digestive power.

It will thus be seen that skilful feeding is the true basis of improving the flock in form. The effect of poor feeding upon the improved Leicester and Cotswold sheep has often been seen, and the deterioration is much more rapid than the improvement has ever been. The flock-owner must, therefore, always regard it as a great misfortune that this flock should be reduced to a scanty ration, even for a short time. No prudent flock owner can afford to economize on the food of his flock; trying to save on their necessary food is simply reckless waste.

The fecundity of the flock can be increased by using a ram from a more fertile breed. When the Costwold, Leicester, or Southdown ram is used to improve the common sheep, the result is to increase the fertility of the next generation. It is also easy to increase the fecundity by selections in the same flock. Breeding will rapidly increase the percentage of lambs from a flock; and this is an item of great importance in a flock used for breeding early lambs. The percentage of lambs from the Merino is usually estimated at 60 to 80 per cent., while in the mutton breeds it is from 100 to 130 per cent. The difference makes a large difference in the profit. The flock owner should study every item, and diligently make the most of it.—*Live Stock Record.*

CINCHONA.

THE HARVESTING OF CINCHONA BARK.

THE following is an extract from a letter addressed to Messrs. Croysdale and Co., by their London Agents, Messrs. Fran Cols Le Mair and Rivers Hicks, on the harvesting of cinchona bark :—

When slicing was commenced in India three years ago, it was with some trepidation that we observed the departure from the old, well-tried and extremely remunerative process of taking the bark by stripping, and it was only when we were assured of the following being facts, that we expressed our approval, the correctness of which we shortly after saw reason to doubt, and later to be certain that the new process was a most lamentable failure. We were assured that the quantity of bark to be taken would be at least double that obtained under stripping. That the trees were more healthy under the slicing than under stripping. That the bark renewed more quickly under slicing than under stripping. That the yield of alkaloid, and especially quinine, increased more quickly under slicing than under stripping. These four promises proved, as many growers believe them to be, the case would of course be made out, and no sane man would take bark by stripping when he could shave or slice. The first slices were undoubtedly richer in quinine and other Alkaloids than the strips taken off the same trees, but that of course had nothing to do with the system, the bark having been grown under the stripping process, and the extra richness was accounted for by their only having taken the outer and undoubtedly richer portion of bark which has not been sliced. The next question, *viz.*, the greater healthiness of the trees under slicing than stripping, was the point which delayed our expressing our antagonistic feeling, for there was no doubt that the trees were healthier under slicing than under stripping, and the first deduction naturally to be drawn was that, if the trees were healthier, the bark must be better; if it were not so, some other influence must be at work. But further observation, that in spite of this phenomenon, bark from trees sliced was each time worse than the last, and that the rate of deterioration was an ever-increasing one, made us feel sure that the argument must be a false one, and in effect, when remembering that the sap of the tree goes up inside the tree, and is there transformed, in Nature's laboratory, into leaves, and comes down outside, down the bark, and is deposited for the most part in the bark, in the shape of alkaloids—when one considers this, all is immediately plain, and actual every-day experience of those whose life is to handle and value bark, triumphs over all the theories. In slicing, you cut through the storehouse of the alkaloid, and leave the contents of the bark on the tree, subject to leakage and to chemical changes, by being exposed to influences they were never intended to be subject to. So far for theory, which as business men we do not believe in. Our theory is made up from our experience. We do not make a theory first, so that even could this theory which we have compiled from observation of effects be overturned by any argument which seems to us very difficult, there would still remain the facts observed to be disposed of, and these are the things that convince us of the suicidal effects of slicing. We have never seen in any case coming through our hands, and where therefore, we had means of verifying the whole matter, we have never seen second slices from identical trees exceed in richness the first slices from those trees. We have observed in very many, too many, cases, a bark arriving the first year in fine, bright, thick, rich slices, commanding the top value, arrive the next year in dull, sickly, [illegible], thin slices of very uncertain value, and of use to only a limited number of buyers. We have known cases of a crop of bark taken by slicing decline in two years, by about 40 per cent in weight and about 30 per cent of the value,—that is, instead of every 100 lbs. of 3s. bark, only 60 lb. of 2s. bark, making every allowance for the drop in the market. What the difference after three years' slicing is, we do not know, but we are afraid it would be something deplorable, and it seems to us that about four years of slicing might reduce a 5 per cent bark to valueless one. Our experience of comparison between the effects of the two processes being chiefly confined to figures relating to bark from mature trees, you have to face a further complication, that is, that your figures, relating to young trees, which in the usual course would be fast improving in alkaloid yield, are likely to be confused by taking any increase in alkaloids obtained whilst slicing, as an effect of the system, instead of, as we contend, in spite of the system: so that we should argue that, if in slicing you get an increase, that increase would be less than it should be by the amount of damage in leakage and chemical change of constitution of alkaloids, resulting from removing the protecting outer layer of the bark. Under the process of stripping in alternative layers, on the other hand, you remove the whole substance containing the alkaloids and the only places where damage can occur is at the edges of the alternate layers left on the tree, and great care is of course necessary in binding the tree up. The other disadvantage of stripping is the damage done to the exposed cambium, and this from two causes. First, coolies, carelessness in [illegible] the cambium with their knives in removing the bark, instead of gently raising it when ready to rise. And the second arises out of the first, or is closely connected with it, taking strips off trees on which the bark has not renewed to a sufficient thickness to allow of its being taken without injury to the cambium. The second cause could easily be remedied by some skilled person going round and making with a patch of paint, or some other easily distinguishable sign, which trees were to be taken. With proper care, trees will go on yielding fine bark for many years, but under slicing, a fine estate may be ruined, at least when mature, in four years. The damage done by slicing is much greater, and sooner perceptible, with crown than with red barks. We advise drying all barks at as low a temperature as possible as any higher temperature than 90 is sure to act prejudicially upon the bark. Drying bark at a high temperature affects absolutely the character and constitution of the alkaloids, rendering the separation of the quinine a matter of great difficulty, in fact fatal, to the bark.—*Madras Mail.*

FORESTRY.

A FOREST SCHOOL FOR ENGLAND.

ON Thursday, the 2nd of August, Sir John Lubbock found the opportunity he has for some time been seeking of calling attention, in the House of Commons, to the important question of establishing a forest school in England. He did so when the House went into Committee of Supply and the vote of £23,232 for the office of woods and forests came on for discussion. Sir John asked the Government to consider during the autumn the question of forest education in this country; and whether the natural forests might not be utilised for this purpose. He said:—

'So much, indeed, had forestry been neglected, that in Scotland the words suggested deer, but no trees; while the idea of foresters in England was associated with the members of an excellent provident institution. Of course, the Crown forests formed but a small part of the subject. There were altogether, in round numbers, 2,500,000 acres of woods and plantations in this country, so that the subject was one of vast importance. Moreover, it was calculated that in Scotland and Wales there were 5,000,000 or 6,000,000 acres at present almost valueless, and which, if judiciously planted, would give large results. In the science of forestry we were, he feared, far behind, most foreign countries, especially France and Germany: and he was very anxious that our landed proprietors should benefit by the experience which other nations had acquired. But let him ask where was a country gentleman who owned woodlands to obtain information as to their management or to procure trained assistants? We had no forest school in this country; we had no class of persons specially trained and instructed in the formation and management of woods. It was, he feared, still true that, as the House of Commons' Committee of 1854 reported, timber is "everywhere worse managed than any other species of property." Unless something were done this state of things would continue. On the other hand, the highest authorities had expressed a very strong opinion that we might make our woodlands much more profitable; they showed one step which was a necessary preliminary. The highest English authorities were strongly in favour of the establishment of a forest school, and had forcibly pointed out the loss which our present system of management, or rather mismanagement, entailed on landowners. Mr. Brown, in his standard work on forests, observed that "if our forests had been judiciously managed we should not find so great a part of the woodlands of Great Britain in the unprofitable state in which they are." 'We were the only important nation in Europe,' argued Sir John Lubbock, without a forest school, and yet, if we included our colonies, our forest, were the largest and most valuable in the world. It appeared to be a very strong argument in favour of the establishment of a forest school in this country that at present the young men who were going out to manage our Indian forests had to be sent for instructions to the great French Forest School at Nancy. No doubt, that was a most excellent institution, and we were indebted to the French Government for the courtesy with which they had received our English students; but the system of education given there naturally contained some branches, as, for instance, the study of French law, that were not adapted to English students, while there were many other considerations, such as climate, which rendered a Continental school less suitable for English requirements. He might add,' he said, 'that no young Englishmen, as a matter of fact, went there excepting

those [illegible] service. For our colonies, again, the establishment [illegible] forest school here would be of very great importance, [illegible] management of their woods would add considerably [illegible] revenue. French foresters had recently been sent to [illegible] Hope and Cyprus, it having been found impossible to [illegible] any countrymen of our own with the necessary knowledge. [illegible], however, he should be asked why the establishment of such a forest school, if it were so urgently needed, should not be left to private enterprise'. The reason was clear. A properly equipped forest school must have attached to it a large extent of forest in various stages, and having a variety of climates and soils. This, it was obvious, no private institution could supply. He did not, however, say that this would necessarily involve the establishment of a Government school. He understood that the Government contemplated an arrangement with the Cooper's Hill College, but he trusted that before instituting a Government school they would inquire whether such colleges as Cirencester could be made available for the purpose, and possibly some arrangements might be devised by which, under careful regulations, the professor and students attached might periodically visit our national forests. He might mention in illustration, that lately the Cape of Good Hope Government determined to appoint a Forest Commissioner, with an income of £800 a year. They could not, however, find any qualified Englishmen, and were obliged to appoint a French gentleman, even though he could not speak English. The Society of Arts had memorialised her Majesty's Government on the subject, and the presence in this country of Dr. Brandis and Colonel Pearson rendered the moment one of which it was desirable to take advantage. He hoped, therefore, her Majesty's Government would not think him unreasonable if he asked them to consider this important 'question.' Mr. Courtney, the Secretary of the Treasury, whilst acknowledging the value of the suggestions put forward by Sir John Lubbock, said that the treasury had not seen their way to do anything in the matter, but promised that the subject should not be lost sight of. This is not very much comfort for those who think that the question ought by this time to have passed the stage of 'consideration,' but it is better than none at all, and Sir John Lubbock, who will, we trust, persevere with his excellent movement, deserves the thanks of the public for what he has so far done in the matter. We shall be glad if he will favour us, in an early issue, with his views on the subject, and we can promise him more space for their discussion than that afforded him by the *Times* —*Forestry*.

THE GARDEN.

CULTIVATION OF THE BEAN.

(*Faba vulgaris*, Mœnch.)

THIS vegetable is an annual, and one of the oldest cultivated plants we possess. Some uncertainty exists as to its native habitat; however, it is generally supposed to be a native of Persia There are two distinct classes cultivated in gardens, *viz.*, the long pod and broad Windsor. The pods of the former are from 5 to 9 inches long, and contain from four to six medium sized beans. Those of the latter are from 3 to 6 inches long and much broader than the long pod, and generally contain three flat large-sized beans. There are numerous varieties detailed in European nurserymen's catalogues, however all are referable to either of these two classes. The long podded varieties are the most prolific, and succeed best in this country. They acclimatise without any perceptible deterioration in quality, and should therefore be always grown in preference to the broad Windsor sorts.

In the plains, beans come in use about the middle or end of February, and continue in season until the end of April. They should be sown in succession from the middle of September to the end of October. Two sowings are sufficient for ordinary requirements, but when it is desired to have them in season for as long a period as possible, three sowings should be made at intervals of a fortnight between. They succeed best in a deep, rich, and somewhat heavy loam. Where the soil is light and sandy, heavy manuring must be resorted to in order to meet with success. I find the following to be a good and economical mode of preparing the ground. Dig trenches 1 foot deep and 18 inches wide, at distances of 3 feet apart for long podded, and 2½ feet for board Windsor sorts. Half fill the trenches with old rich manure, and dig or fork it into the subsoil at the bottom of the trench. Then fill up the trenches with the surface soil and also give it a liberal supply of manure. The trenches will now form low ridges owing to the manure and looseness of the soil. They should next be pressed with the feet, and if the soil is still above the surrounding level, part of it should be drawn to each side, leaving a space 18 inches wide down the whole length of the rows. The soil drawn away may be left along both edges of the latter for the purpose of facilitating the retention of water when irrigating. The seeds should be inserted 2 inches below the surface in double or single lines in each row at 6 inches apart, and the same distance between the lines when two are sown. The double line is preferable to the single one, for the following reasons. If the seeds are imported many of them fail to come up, and the resulting vacant spaces, besides being a waste of ground, give the plot an untidy appearance. In a double row, vacant spaces, as a rule, are not so numerous, besides the plants are much benefitted by the support and protection they afford each other during storms.

The germinative power of the seeds is much increased by being soaked in warm water for six or eight hours before sowing. Care, however, must be taken that they are not again dried up by being inserted in hot and dry ground. When the latter is in the state mentioned, water should be given immediately after sowing, and the ground kept damp by subsequent waterings until the seedlings appear above ground. During their progress water should be freely given, the ground kept free of weeds, and the soil frequently stirred between the plants. When the flowers begin to appear, a slight earthing up around the neck of the plants is beneficial. When the stems are well covered with flowers or when about 1½ or 2 feet high, the point of every shoot should be nipped out. If this is not done they will continue to grow and flower without forming any pods. As already mentioned, the long pod acclimatises readily. When seeds for future use are desired, they should be collected from the pods lowest down on the stems, as these are invariably the largest and best developed The bean is not subject to disease or to the attacks of insects when cultivated on the plains

On the Hills—autumn sowings come in use in May, and by successive spring sowings beans can be kept in season until August and September. A small sowing should be made in October or November for the early crop of the following spring. Those for the main crops should be sown in succession from the beginning of March to the end of May, at intervals of about a fortnight between. The mode of cultivation is the same as decribed for the plains, and need not again be detailed. The plants are sometimes attacked by a species of aphis or green fly. The best remedy is frequent syringings with soap and tobacco water.—W. G. —*Indian Forestry*.

THE GARDEN ANEMONE.

THE Garden anemone may (*A. hortensis*) be said to comprise early summer and autumn varieties, so long as may they be had in flower by adopting the practice of sowing at different times. The beauty and almost limitless variety which may be obtained from a cheap packet of seed of the garden anemone is astonishing. We know few plants that present the same rich variety of colours which this fine old plant does. From such high-toned colours as brilliant crimson, down to pure white, through every one of the primary colours, in nearly every variety of shade, the transition from one shade to another is perfect and complete. Then the simplicity of their culture renders them most desirable to all who love their garden, yet neither have much time nor money to spend on it. By sowing a packet of seeds at the present time an excellent crop may be reared for next year's display, in the flower garden, and in fact many years' because the roots are perennial, and may be kept for many years without deterioration of vigour, if well cultivated.

The manner in which they are usually done, however, is not the best. They are sown usually too thick, and no thought is given to the necessity of thinning them out, so as to allow of a vigorous development of the small number which may be required for the purpose of keeping the garden gay. If only a small bed is wanted, or a few patches, the seed bed should be thinned out equally the same as if thousands were required, and the trimmings may be utilized by being transplanted while young to any spot that wants lighting up with flowers, such as shrubbery borders or the margins of paths in the vegetable garden.

The anemone likes a rich soil, but the manure used should not be of a crude nature. It should be well rotted, and, if possible, mixed with old turf from rich pasture that has been stacked for some time to rot In sowing the seeds there is some difficulty, owing to the woolly covering that envelopes each seed, of distributing them evenly. This may be overcome by turning the seeds into a basin, and sprinkling over them some moist sand and mixing the whole and rubbing them together till the seeds separate; the sand will require to be about three times the bulk of the seeds in order to make a complete separation of the seeds. Sown at the present time, the plants will be strong enough to stand the winter, and may be transplanted next spring as soon as they show signs of growing. They usually do better when sown in lines rather than broadcast, and they can be transplanted more easily when so done, because plants may be lifted with less disturbance to their roots. Sowings may also be made in spring and early summer—say in April, June, and July—which will keep up a supply during the whole of the summer —*North British Agriculturist*.

ON SOME NEW GARDEN PEASE.

THE number of new candidates for public appreciation that turn up annually now-a-days in every department of gardening is so great that it behoves every one who has a garden, and wishes to make the most of it, to examine and criticise every new comer severely before he accepts it as worthy the reputation with which it is sent out. In no department recently, perhaps, has there been more energy displayed than in the vegetable garden, and perhaps no subject thereof has received more attention than the pea. Being one of the most important of summer vegetables, certainly the most popular, no wonder it has received the large amount of attention it has done. According to a report in the *Gardeners' Chronicle* of last Saturday, we find there are no fewer than seven new varieties on trial at Boreaton Park, which bid well take a first place among the existing sorts already in possession of the public. They are—

Duke of Connaught, a main crop summer pea, a strong growing sort, attaining a height of about 5 feet, free bearing, with large, long, well-filled pale green pods. Described as well fitted for

the exhibition table. Awarded a first-class certificate by the Fruit and Vegetable Committee of the Royal Horticultural Society of London.

Progress is a fine sample of the *ne plus ultra* type, with large broad, pods which fill well, vigorous and free bearing.

Magnificent is described as one of the very finest main crop peas in cultivation. It has very large, broad, long, well-filled and singularly handsome pods of a pale green colour, square at the end, which are unrivalled for exhibition purposes. It grows to the height of about 4½ feet. It belongs to the Telephone type, but has none of the puffy appearance which that variety possesses.

Invincible—which also passes under the name of *Home Ruler*—has large, square-topped pods, having nine to ten fine peas in each.

Victor is a dwarf pea of about 3 feet growth. It is a very prolific bearer, with fine, well-filled, square topped pods, which stand well.

Perpetual is of the Veitch's Perfection type. It is a profuse bearer, and perpetual, as the name implies, carrying its crop late into the autumn.

Duchess of Albany is described as fine, but too near in character to the Duke of Connaught to be considered distinct.

The value of these peas, however, must be taken relatively, and with caution, till they are more definitely proven. There never was a time when peas of a superior kind more abounded than the present, and some of the older kinds, such as Veitch's Perfection Champion of England, and many are unsurpassed for their general good qualities. While, therefore, we should be on the outlook for the results of careful work on the part of hybridizers and selectors, we must make up our minds to some measure of disappointment in following up or keeping abreast of the march of progress.—*North British Agriculturist.*

CHIVES *VERSUS* SILVER-SKINNED ONION FOR PICKLING.

It is not generally known that chives make a very delicate and valuable pickling onion. The way in which chives are usually grown, *viz.*, allowed to remain in the same spot for many years, is not likely to lead to the development of roots in any degree fit for pickling, because they are too much crowded to admit of anything but the smallest sized bulbs being obtained. If, however, they are planted out in the month of October singly, instead of in clumps unbroken up, very fine roots for the purpose will be the result. They are milder than the silver-skin onion or the common sorts either, and are more crisp as well, eating more like nuts than pickled onions of the usual quality. The ground should be fairly well cultivated for them, digging well, and giving a fair amount of manure. In planting, drills about six inches apart and about 1½ inches deep should be drawn for them. In these drills the roots may be sown thickly, and covered as if they were peas or any other seed.—*North British Agriculturist.*

MINERALOGY.

THE SINGARENI COAL MINES.

DR. KING'S LECTURE AT THE MUSEUM.

During my absence in England for the last two years, the opening up of this country by a more extended system of railways has been under the consideration of the Government, particular attention having been devoted to the coal-producing capabilities of the regions adjacent to some of the proposed lines. It was therefore with considerable pleasure that I saw the Singareni coal-field once more receiving that notice which it deserves. Hidden far away in a little-frequented part of the Nizam's dominions, and very small, it is yet the only field certainly known to contain seams of coal of importance within reach of this Presidency.

It may indeed be said at once, at the outset of this lecture, that there are only two areas of coal-bearing rocks in this Presidency. One of these is at Beddadanol in the Godavari District; but after being bored the results were so poor that discontinuance of the explorations was reluctantly decided upon; for any further examination could only have been carried on in ground where the placing of sites for bore-holes would have depended very much on what was little better than guess-work as to the probability of their striking any coal even at great depths. The second field is near Bhadrachellum on the British side of the Godavari; its area is unfortunately very limited, and there appear to be only 21,000 tons of coal, of which little more than one-half can be properly worked. There are, however, other areas not far from these which, though small as compared with the coal-fields of the Central Provinces, are of sufficient extent and capability to make them of exceeding interest to Madras. It is true they are in what is at present a very out-of-the-way region, and—as may be seen on the map—they look infinitely small in the vast area of Southern India: still, the opening up of the country will come in time, and the amount of coal in a field is not always proportionate with the extent of that field superficially. The saying, "little and good" may be applied to coal-fields. The demand for coal is now so urgent and far-reaching that very extraordinary efforts must be made to win it; and I hope, with but few data at hand, to show that the resources of Singareni and the other fields to be mentioned are likely to repay such extraordinary efforts. In fact, that it may be possible, for very many years to come, to lay the coal down at Madras so cheaply that it will compete very favourably with the fuel now obtained from Great Britain or Australia.

At this point, and before going further with the subject, I shall ask those of my hearers who are up in the geology of Indian coal, to bear with me while I explain a few technicalities which may perhaps make the story of Singareni clearer and more interesting to those not so happily prepared. In describing the geology of India, it has been found convenient to call the country lying to the south of the great alluvial flats of the Ganges and Indus, or the Indo-Gangetic plain, Peninsular India; while all the country to the north is considered extra-Peninsular India. The present argument is confined therefore to certain rocks or formation of Peninsular India. A very remarkable and extensive serious of sandstones and other rocks, characterised by the fossil remains of plants and hence often called the plant-bearing series, is developed in the central and north-eastern part of this country, and it stretches down towards the Madras Presidency from the Central Provinces, by the Pranhita and Godavari rivers. This great series contains a sub-division of coal-bearing rocks, but these are not of the same age as the coal-bearing rocks or coal measures of Europe. We do not know of, nor do I think there are, any rocks of carboniferous age in Peninsular India. To put it proudly; this wonderful series of plant-bearing sandstones is a speciality of India; it is also met with in South Africa and in Australia, but it is best developed in India, and—shall I say it?—has been best worked out through the sure labors of Mr. W. T. Blanford, Dr. Feistmantel, and others among my colleagues. It is in fact an Indian, rock system, standing on its own lithological, strategraphical, and palæontological merits, confined within no limits of European or American classification, but demanding a place for itself in the great geological history, and worthy of its classic name, the *Gandwana system.* A very marked member of the system, or rather of the lower part of it, is the *Damuda formation*, containing the Indian coal measures. Such terms, however, as coal-measures and coal-bearing rocks are apt to mislead, if only in the matter of their being a difference of age between such rocks in Great Britain and in India. Hence, when they are spoken of here, it is safer and better to call them *Barakars* and stones or the *Barakar* group or sub-division of the *Damudas*, and thus the term stands not merely for rocks named after the Barakar river, but for a group of rocks in which the coal proper of India is known to occur.

Thus, when a geologist finds himself on lower Gondwanas, he is on the alert for *Damuda* strata; but if he feels—as I did when walking over the Singareni country—his foot drag over the peculiarly rough surface of *Barakar* sandstones; then, no India trapper can beat him at taking up a trail which shall lead in all probability to coal. Although it has just been stated that the Gondwana system requires a place of its own in Geological history, and that its *Damuda* formation is of a different age to the carboniferous formation of Europe, they can be placed approximately alongside the European order of classification thus:—

European classification.			*Indian classification.*			
Mesozoic.	Jurassic.			Mahadeva	Upper	Gondwana.
	Triassic.			Rajmahal		
				Panchet		
			Kanigunj			
			Kamthi	Damuda	Lower	
			Barakar			
Palæozoic.	Permian			Talchir		
	Carboniferous	Coal-measures				
		Mountain Limestone.				

Concerning the groups of the *Damudas*, it is only necessary to state that the *Kamthis* do not contain coal, and are not known to have any seams worth consideration. The *Barakars* are coal-bearing *par excellence.*

The *Talchir* formation need only be referred to here because it occurs at Singareni associated with the *Damudas.*

I trust it will be perfectly understood that the term coal is here used for the fuel properly so called which every European ought to be able to recognize at once; though, indeed absence from home and the not having seen or handled it for years, or carelessness about noticing a stone which is as typical of England as anything else, have made some men so blind that they have mistaken the hard and grassy black mineral *tourmaline* for coal, the blackness of colour generally being the one main attribute of an otherwise easily recognizable rock. Other substances such as lignite, like that occurring on the Travancore Coast, or the compressed and partially or wholly carbonised vegetable matter of the alluvial deposits of Pondicherry and Cuddalore, however useful they may turn out as fuels hereafter, are not to be thought of as coal.

There is no doubt about the "stuff" (as some people have called it) of Singareni being coal; several tons of it were brought down to Madras in the Duke of Buckingham's time, when it was tried on the Madras railway by Mr. Trevethick, who reported it as coal without a question as to whether it was anything else. The only doubt was as to its being good enough for the work required from coal or other fuel on the Railway, and the Locomotive Superintendent decided that it was so fitted, if it could be landed at the railway at a sufficiently cheap rate.

The coal-fields now under consideration are situated near the south-eastern limits of the area of Lower Gondwana rocks that is on the lower part of the Godavari valley, or close to it, Singareni being the only one not absolutely within the drainage area of this river. They are Tatpalloa on the left bank of the British side of the Godavari; Singareni, Sivararum and Madavarum on the Nizam's side, and Beddanol in the Godavari District. There are others, such as Lingala, Kamarum, Bandala and Kinarsaul, but these are not of immediate interest,

If one of the more important of these fields be only opened up, and an easy and cheap route be made for getting the coal carried away, the rest can be utilised in turn. I say this because, as already stated, the fields are small, and in case of any very extraordinary demand, it is as well to know that there are reserves which shall prevent failure of supply, those especially considering the enormous outlay required to win the coal and distribute it over the land. Singareni, though it be of small size, is the most important field on account of its having been best expl red, and because its coal is known to be good in quantity and quality. On the other hand, Sivawarum, Madaverum, and Beddadanoi are parts of connected area in which there may be large extensions of Barakar strata. There are fair indications of good seams at Sivawarum ; but so far, Beddadanoi has failed to show anything better than poor coaly shales. The Singareni field is situated about 17° 35' N. Lat., and 80° 22' E. long., in the eastern part of the Kundikonda taluq of the Nizam's dominions. It is about 130 miles from Hyderabad, 50 miles from Hanimkonda through which town it is proposed to run the Hyderabad-Chanda railway, 40 miles from the nearest point on the Godaveri opposite Bhadrachellum, and between 80 and 88 miles from Bezwada, whence there is canal way to Madras. Kummamat, the nearest large town, lies about 24 miles to the South. The country is very poorly populated with few small villages in the midst of jungle ; but fortunately for railway purposes in the plains and not hidden away among hills as is the case with some of the other fields. It was even difficult to give this field a name ; but it is called after a once large village which, though not actually on coal-rocks, is not far from them. There are about 19 square miles occupied by the Damudas, only 8 of which can be considered as Barakars, a considerable portion of them being covered up or overlaid by Kamthis. When I first found this field, all that was evident to me was that it was one of Barakar sandstones. I soon found that they are associated not only with their overlying group the Kamthis, but that the Talchir for ation underlies them. Such an association of the lower Gondwanas was eminently satisfactory as showing that this field was not a mere dying out patch of a single group ; and therefore my hopefulness of finding coal was considerable. My search was eventually rewarded by finding a solitary out-crop of coal in a pot-hole in the bed of the main stream, the waters of which happened to be unusually low at the time. Having thus ascertained the existence of coal, I completed the survey of the field, and pointed out where trial borings should be made. The borings were subsequently carried out by Mr. Heenan, the Mining Engineer of the Nizam's Department of Public Works, and I had the good fortune to visit the place once more while he was at work. On this occasion, the bore-holes indicated that there were other seams besides the one I had found ; and altogether my friend was in the highest state of excitement over the quality of the coal and its extent. Sober calculation was however brought to bear on the data so obtained : for, there is no getting over the fact that though a cubic yard of coal weighs about a ton, there are only so many cubic yards in a square mile,, and Mr. Heenan had as yet hardly bored over a square mile of ground. I now come to a part of the subject of my lecture, the consideration of which is fraught with considerable difficulty. I refer to the ascertaining of the amount of coal likely to be got out of a field like this, and I must confess to a considerable amount of hesitation in taking it up, because the calculation is beset on all sides by such pit-falls as failure in continuity of the seams, doubts as to whether the seams are always the same, and variability not only in the thickness of the seams, but in their composition. Further, in our examination of the lower Gondwana formation as it extends down the Godavari valley from the Central Provinces, a tendency is observable in the Barakars to hold less and less coal as though they were thinning out or dying away to the southward. Hence the chances are that an outlying pocket of the lower Gondwanas such as this little area might only hold fitful and capricious seams. On the other hand, it is possible enough for such a pocket to be a rich one, and I am bound to state that such appears to be the condition of things here.

Be this as it may, Mr. Heenan completed his explorations, and in 1875 he prepared a *resumé* on "Coal in H. H. the Nizam's Dominions," in which, among the accounts of other fields, he gives an extremely encouraging sketch of the capabilities of Singareni. To this *resumé* I am indebted for the data and calculations which I shall now place before you, and which I shall now take the liberty of discussing, seriatim, as closely as possible by the light of my knowledge of the behaviour of the Damuda formation and its groups in the Godavari valley. For convenience of work and other causes, Mr. Heenan examined the field in two parts, a northern one in which the out-c op occurs, and a southern one. He put the bore-holes down in the first portion over an area of one-and-a-half square miles, outside of which there is still a good deal of Barakars ; and in the southern part he bored over about one-and three-quarter square miles, leaving a similar selvage of sandstones all round. In the northern-half of the field there are four seams of coal, the uppermost having an average thickness of six feet, the next two have an average thickness of three feet each, and the bottom one, at 151 feet below the surface, is sometimes 34 feet thick. The bore-holes appear to have each pierced the four seams, so that the calculated area is the same for each. Indeed, Mr. Heenan specialises the bottom seams as having this area ; though he does not venture to estimate its average thickness very closely, as it is on an uneven lenticular bed, thinning out rapidly at the edges. In the southern portion, the four seams are still extant, but they vary in thickness and depth. I will now read to you what Mr. Heenan says of the capabilities of the seams,—"The upper or King's seam"—as my friend calls it—"extends over an area of one-and-half square miles on an average thickness of six feet throughout, and allowing one-third for pillars, etc., there will be (5,500,000) five-and-half million tons of workable coal." This tonnage is calculated as follows :—A cubic yard of coal being equal to a ton weight, 1½ square miles, which will give double the number of cubic yards, or 9,292,800 tons. It is usual in coal-mining to have about one-third of the coal in the form of pillars or blocks for the support of the roof which amount being substracted from the above tonnage leaves 6,195,203 tons, rather over Mr. Heenan's estimate. There is always an enormous deal of waste in working coal, especially with Indian coal ; while there is sure to be a lot of poor shaly stuff which will not come up to the requirements of railway fuel ; I would, therefore, subject the amount given above to a further reduction of-one third when the result would be 4,130,134, or say 4,000,000 of workable coal. Mr. Heenan next says :—"The second and third seams extend over a like area, on an average thickness of three feet each throughout, and will produce (8,500,000) eight millions and half tons of workable coal." There is some mistake here, the aggregate thickness of the two seams is only 6 feet, and the area is the same as in the upper seam, hence the probable out-turn must be the same or 4,000,000 tons. I will not enter into Mr. Heenan's account of the bottom seam : he clearly had not obtained sufficient data for a fair estimate at the time of publishing his *resumé*. He estimates, however, that there may be 8,500,000 tons, which I very much fear, will be found above the true quantity. Whatever it be, I refrain from making any guess about it. Suffice it to say that the seam is sometimes very thick, and it may give such thickness of good coal, in the area defined by the bore-holes as to keep the total tonnage of the northern part of the field well above eight or nine million tons. In the southern area, the lower seam thickens out to ver 50 feet in some places, but the quality of the coal is said to be variable. The three other seams are slightly reduced along the western edge of the field. They are somewhat larger, and Mr. Heenan calculates, on a corresponding increase in the probable out-turn, which I would, however, reduce to about the same amount as in the northern field. On the whole, the possible out-turn of good coal may be reasonably reckoned as 16 or 17 million tons, for the whole field : which is indeed vastly larger than I ever expected for so small an area. I am bound to be as cautious as possible in a calculation of this kind ; but I must at the same time give due credit to Mr. Heenan's stated facts concerning the thicknesses and areas as shown by his boring explorations. All that we feel justified in doing is to weigh his opinions on the quality of the coal in the seams and the likelihood of their being so permanent in their thickness as he seems to think they are ; and I think the reduction I have made on his total estimate of 46 million tons will meet the contingencies likely to be encountered.

The quality of the coal is the next point of interest. That which I myself obtained at the outcrop was tolerably light and compact,—not shaky, but charged slightly with patches of powdery charcoal, breaking into big lumps, and having the bright lustre of ordinary coal. After it had been dried in the sun, it soon made a great blazing fire in front of my tent, which was kept up all night by the people as being something new in that country. The next morning all that remained was a heap of powdered ashes and some fragments of harder cinder which were easily knocked into powder. An analysis, made at the survey laboratory in Calcutta, gave the following results :—

Fixed carbon	...	... 62·4	Total 100·0
Volatile matter	...	... 22·6	
(Moisture 6·0)	...	... ...	
Ash	...	... 15·0	

This shows a very fair style of Indian coal ; the 15 per cent of ash is, however, just within the limit of coal having a ready sale in India, while the proportion of fixed carbon is much higher than that of average Raniganj coal. The moisture is lower than is usual with Godavari coal. Subsequently, the coal underwent more practical tests. A shaft was run down 200ft. away from the outcrop to 60ft. which reached the bottom of the uppermost seam. About 300 tons were extracted and sent to Hyderabad, where it was found to work very satisfactorily, both in the stationary engine and at the workshop forges. On the Madras Railway, about three years ago, experiments showed that the coal is very hard, makes little dust, and leaves very little ash in the smoke box ; there was no difficulty in making steam with it, but it was found to make a great deal of ashes in the ash-pan, for which, of course, special arrangements can be made. The great point about these experiments is, that the coal was not thrown aside as being of no account ; Mr. Trevethick in his report calls it a "good serviceable fuel ;" and says, "that if the facilities for carriage are such as will admit of its being delivered to consumers at a reasonable rate, it should be well worth working." The coal of the upper seam has only been practically tested ; but, by all accounts, that of the other seams will be found to be of similar quality. Mr. Heenan gives the following analysis of coal from the flower seam, in which the percentage of ash is remarkably low :—

Fixed carbon	...	...	...	... 66·00
Volatile matter	...	...	...	... 23·00
Ash	...	...	...	... 11·00

In considering, now, the means of getting this coal to Madras, or indeed the having it transported anywhere, the depth at which it lies, the nature of the locality, and the means of approach are matters of great importance. The lowest seam is only 150 feet from the surface in the northern part of the field, and it never runs beyond 250 feet ; so that the pit shaft or shafts will not involve any extraordinary sinking. Then there will be no great demand on pumping apparatus ; the locality is a dry one being in a very small drainage basin of about 37 square miles, at the head of one of the minor feeders of the Munier tributary of the Kistna

river. The situation, as I have already said, is favourable owing to its being in the low country, and thus easily accessible from the wide open plains of Kummummet. It is, of course, a jungly region, of secondary forest ; but this will be of advantage in supplying timber for the works and railways. So convenient is this field in every way, that I used to dream of it thus :—If the Nizam's Government do ever carry out a system of railway—as was then proposed, between Hyderabad, Chanda, and the Kistua frontier, viâ Hanimkonda ; why should not a zemindar—say a European —at Singareni, import his mining-plant viâ Coconada and the Godavari, sink his pit, lay down a tramway from the colliery to Kummummet, and supply the railway at Rs. 5 a ton ? I really think still that this might be done at a profit.

This brings us easily to the problem how to get the coal out of the place and lay it down at Madras at a fair rate. In the Government enquiry or correspondence of 1879 on the capabilities of the Singereni and Godavari coal, Mr. Trevethick stated that the cost of the Godavari coal should not exceed Rs. 15-4 per ton, stacked in the Royapuram yard, to attain the same result as is got by using patent fuel at Rs. 22-11-9 per ton. I very much fear that since then the price of patent fuel has gone down somewhat ; in which case Singareni must yield its fuel at even a lower price than Rs. 15-4.

The first point is as to what the price may be at the pit's mouth. The coal already mentioned, as having been sent down to Madras, cost Rs. 8-8-2 per ton at the mouth of the shaft. Of course the shaft is only a temporary affair, with no appliances in the way of machinery and the coal was got out in the most primitive manner, at a price very considerably above what could be done at proper colliery works. Coal is sold at pit-mouth, in Raniganj and other places on that side of the country, sometimes for so low a price as Rs. 2-8 or 3 per ton. At Warora in the Central Provinces, coal is sold to the public at Rs. 7-8 per ton, unscreened ; screenings or small coal at Rs. 4, the price to Guaranteed or State Railways being lower. The Warora prices cannot be taken as a fair criterion; the colliery itself was an entirely abnormal Government work, an encouragement work, in fact, and it was constructed at very enormous expense ; and worst of all the Government still works t. It seems hardly the correct thing for Government to work a colliery ; it is a question, indeed, whether Government should force a commodity on consumers who are not ready for it, or whether this commodity should be allowed to wait until it is wanted when private enterprise will most assuredly get it at a far cheaper rate. It is also a question whether opening up a coal country by roads or railways is not a more legitimate province of Government than colliery work. The intention was admirable ; Warora is a splendid work ; but it cannot be expected to pay a profit on its cost ; it ought to be given over—even at a loss—to people who will work it at a profit. Then, the price of its coal will arrange itself. I think myself that considering the working of Singareni will be comparatively easy, the coal ought to be sold at a good profit at the pit-mouth for Rs. 5 a ton, or, let it be Rs. 6 as proposed by the Consulting Engineer to Government for Railways, in the correspondence of 1859. This Rs. 6 per ton coal has, however, to be carried to Bezwada by railway or road. From all I can learn, there seems every prospect of a railway ; and for this carriage it is tolerably easy to calculate the amount to be added to the prime cost. This line of railway will in all probability connect Bezwada with Hanamkonda, which appears to be the place for a great central junction on the eastern side of the Nizam's Dominions, so that it may as well run close to Singareni instead of there being a special coal line 24 miles long between the field and Kummummet. In this case the line from the coal field to Bezwada will be about 80 miles long. It will be, comparatively speaking, over a very easy country. I have walked pretty well over the whole of it going southwards to Kummummet, and then south-east somewhat in the direction of the old high road to Mudalera. No particular stream comes in the way for 24 miles, when the Waira, a strong tributary of the Munier, is reached. Then, rather more east-south-east, over a broken country with another smaller stream at 11 miles ; after which, S.S-E. by the village of Yerrapoliam, and so through the pass between the Kondapili and Kowteswar hills for 25 miles more to Bezwada. There is no use in trying to shorten the distance between the coal field and the latter town to 72 miles in a direct line, as is put down in the Government correspondence. The line I have indicated is the shortest, and I think the most convenient that can be run, and it will be at least 85 miles long. I prefer it to the more obvious route by Partial and the Kistna river, which would run over a troublesome country in the alluvial flats, while it would be 2 or 3 miles longer.

It is hardly necessary to point out how greatly Hyderabad will benefit by such a line of railway irrespective of its traversing a coal district. This eastern Hyderabad country is the poorest region I have been in in Southern India, as far as population and cultivation are concerned ; though it has resources of great value if they could only be brought under the influences of commerce and industry. A railway from the Kistna delta will carry produce, and perhaps people into it, and it will carry out produce which at present lies fallow. The Chandra railway, however useful it may be, has to run a much greater distance over a far wilder and infinitely more difficult country. Chanda wants little that Hyderabad can give ; Madras requires much for which she will give a fair price.

To return, however, to the subject of the carriage of coal. This mineral is carried in Bengal and Central India, by rail, at about Rs. 2-5 per ton for 100 miles. The Madras Railway rate is much higher than this, and the Nizam's State Railway carries it for about Rs. 3-2. However, perhaps both railways will carry it at a lower rate when they have to carry it in any quantity. Not to spare things down too finely, let the 3-2 rate be taken, and this will raise the price of coal at Bezwada to Rs. 8-8.

There is then the water carriage for 274 miles by canal. Referring again to the Government correspondence of 1879, it appears that with proper boats and an organized system of transport the rate should not exceed 2 pies per ton mile, which will make the charge Rs. 2-13-8 per ton for the canal or Rs. 11-5-8 as the prices of the canal at Madras ; a futher slight charge must be added for carrying and stacking at Royapuram yard, which certainly will not run the price beyond Rs. 11-8 a ton, well within the Rs. 15-4 laid down by Mr. Trevethick. It must not be forgotten that Rs. 6 is the proposed prime cost in this calculation ; not Rs. 5 as I would have it.

The present normal annual consumption of coal on the Madras Railway is only somewhere about 12,000 tons, equivalent to 16,000 tons of Singareni coal ; hence, if there were only this railway to feed and its fuel reserves held out at their present rate, the Singareni field might be expected to last for over 1,000 years. The fuel reserves are uncertain ; the Madras Railway Company may require more coal, the South of India Railway is ready to take a very large amount, the eastern system of Nizam's railways will require fuel : and altogether it is not improbable that this annual demand for coal might run up to 50,000 tons in a very short time. With such a drain, this field might hold out for 350 years ; perhaps under certain views quite long enough for us in India ! On any view, if a greater demand arise, there are other fields to fall back on.

There is one other consideration regarding the transport of Singareni coal, and that is on the supposition that the Bezwada railway scheme might fall through, or remain in abeyance for years. In this case better roads or a tramway must be devised, and then it will be better for such a route to run as nearly as possible straight to the Godavari, when there would be water-carriage without break of bulk all the way to Madras. The tramway would go 40 miles long to a point opposite Bhadrachellam. It would run through a wild country ; but regarding it, I can also say, from personal experience, that there will be no engineering difficulties of any consequence until near the river, when deep alluvial gullies, subject to floods, come in the way. The length of waterway would, however, add considerably to the price of the coal, already burdened with the charges on the coal line of 40 miles ; indeed, the price at Madras would be just a fraction over that which I have calculated for the railway route. After all, the great advantage in the proximity of the river to this coal field is that, with an ordinary road in the direction indicated, colliery plant could be imported and laid down on the field at a much less cost than by any other route. The port for landing is Coconada, whence there is canal and river way to the Hyderabad country opposite Bhadrachellum.

I hope I have now shown you that Singareni is the immediate field for opening up ; that 17 million tons of coal may be reasonably expected to be got out of it—if not the 46½ million tons of Mr. Hoenan's estimate ; and that a railway between it and Bezwada will help to land coal in Madras at Rs. 11-8 per ton.

The other fields in the neighbourhood are Sivawaram and Madaveram. They, with the so far unfruitful field of Beddadonol, are batches of Barakars situated on different sides of a large area of Kamthi strata which may be called the Ashwarapett region. This area of Kamthis is about 240 square miles in extent, and it lies alongside the zig-zag portion of the Godavari, between Bhadrachellam and the 'Gorgi' of the river. Thence, it stretches down towards the Ellore and Yarnagudem part of the Godavari District.

Sivawaram and Madaveram are situated at the north-east angle of this area on, or close to, the bank of the river : they both contain seems of coal of greater or lesser importance. Away on the western edge of the area, near Chundragunda and Kdnnigiri, there is another patch of Barakars which has not, however, given any signs of coal as yet. The probability is very strong that, between this and Sivawaram, there may be a continuous and thus extensive field of the same rocks underlying the Kamthis. This part of the country is entirely in the Hyderabad territory, and Mr. Hoenan made a few bore-holes in the neighbourhood of Sivawaram. He found that there is a seam one foot thick at 240 feet from the surface, a four-foot seam at 272 feet, and a third seam six-feet thick at 313 feet. The coal of the second seam is reported as tolerably good. All this shows that the prospects of the Sivawaram country are favorable ; the depth is at the same time considerable for Indian coal measures.

The Beddadanol Barakars undoubtedly stretch away under the Ashwarapet country, or into the Hyderabad lands : and perhaps also down under British ground towards Ellore. The depth to which borings would have had to be carried had they been started in Kamthis, and the incertitude with which I should have had to point out sites for such opinions, practically frightened me from advising Government to proceed further in the work of exploration I am bound to admit this in the face of such vastly bolder ventures as were carried out—fruitlessly as far as striking coal rocks was concerned—in the Nerbudda valley under the direction of the Chief of the Geological Survey. There, however, the question for or against the occurrence of coal at a reasonable depth, in a region advantageously placed for the railway, was practically decided ; and it would have been for the best had a similar end been gained in this part of the Godavari District. This may yet be called for ; it would be eminently satisfactory for us to have a decent field of our own within perhaps 20 miles of the Canal, somewhere in the neighbourhood of Ellore ; and on this last view I can only now say that before leaving this Presidency, I hope to prepare a notice of the conditions of the Damudas in that region in case of more extended boring operations. In the meantime, however, too much attention cannot to be devoted to the development of the Nizam's field ; and I trust this description of them may lead to increased interest in them, not only with the public and the Government here, but with the Nizam's Government.—*Madras Times.*

COAL IN THE KHASIA HILLS.

NOTE ON THE CRETACEOUS Coal-measures *at* Borsora *in the* Khasia Hills, NEAR LAOUR IN SYLHET. BY TOM D. LA TOUCHE, B. A., GEOLOGICAL SURVEY OF INDIA.

I HAVE visited and examined a section of the coal-bearing rocks situated at the foot of the Khasia Hills to the north of the district of Laour.

The section examined occurs in a ravine, at the mouth of which stands the Garo village of Borsora, about 5 miles west of the point where the Panatibh or Jadukhata river leaves the hills. At the edge of the plains on either side of this village nummulitic limestone is exposed dipping to south-south-east or towards the plains at an angle of 38°. On proceeding up the ravine along a path on the west side of the stream no sections of rock *in situ* are seen, but the path is covered with blocks of a coarsish yellow and brown sandstone. The path rises for about half a mile until the mouth of a small steep ravine on the west is reached, in the sides of which the coal seams are exposed.

At the junction of the two ravines carbonaceous shale is seen in the bed of the stream dipping to south-south-east at an angle of 12°. Upon this rests a seam of good coal 3 feet 10 inches thick extending for about 20 yards along the side of the ravine. This is overlaid by 5 feet of shaly sandstone, upon which rests a second seam of coal 3 feet 4 inches thick. This seam has been disturbed by several small faults or slips, and parts of it have been denuded to some extent before the deposition of the overlying sandstone, so that its thickness is not so constant as that of the lower seam. Proceeding up the ravine about 60 feet of fine yellow sandstones are passed over, and a third seam of coal is met with cropping out on both sides of the ravine. The thickness of this seam could not be determined exactly, as a small landslip has occurred in the rocks above, and has partly covered it, but it is at least 4 feet thick, though not quite free from shaly partings. Above this the ground is covered for 50 or 60 feet with the debris from the slip above mentioned, consisting of fine yellow sandstones and shales with many fragments of coal, and above this, again, at the top of the section, is a fourth seam, of shaly coal, 2 feet thick. In the whole section, therefore, of about 150 feet, there are about 12 feet of good coal, distributed in three seams as shown below, in descending order:—

		Ft.	In.
Shaly coal	about	2	0
Fine yellow sandstone and shale	,,	60	0
Coal seam, No. 3	,,	4	0
Fine yellow sandstone ...	,,	60	0
Coal seam, No. 2	,,	3	4
Shaly sandstone	,,	5	0
Coal seam, No. 1	,,	3	10
Carbonaceous shale, thickness unknown.			
Total ...	,,	138	2

The coal of seams Nos. 1 and 3 is much disintegrated by exposure, so that it is difficult to get good specimens for analysis, but it appears to be a very good coal, with a bright fracture and black colour, containing numerous specks and nests of a kind of fossil resin. This resinous substance, which is characteristic of the coals of this region occurring in cretaceous rocks, together with the position of the seams below the nummulitic limestone, shows that the coal is of the same age as that of the Garo hills and the small basin at Maobelarkar, and is therefore distinct from the coal of Cherra Poonjee, which occurs above the limestones. The coal of seam No. 2 is more compact and browner in colour, and is traversed in all directions by small joints, it also contains specks of the fossil resin. Samples assayed in the Survey laboratory by Sub-Assistant Hira Lal gave the following satisfactory results:—

	Seam.	
	No. 1.	No. 2.
Moisture	5·84	3·02
Other volatile matter . .	35·16	39·58
Fixed Carbon	50·40	50·80
Ash	8·60	6·60
	100·00	100·00

No. 1 does not cake; ash pale red.
No. 2 cakes; ash red.

The section examined is very similar in some respects to one described by Captain H. H. Godwin-Austen (*Jour., As. Soc. Bengal*, Vol. *XXXVIII*, Pt. *II*, No. 1, 1869) as occurring on a small tributary of the Umblay near the village of Nongkerasi, about 10 miles to the north-west of Borsora; but to determine whether the coal-measures are continuous between these points would require a more detailed examination of the district than I was able to make. The only means of getting sections in such a country is to follow up the hill streams in which fragments of coal are found to the outcrop of the seam, and at this season (June) these streams are liable to sudden floods and become quite impassable. If it should be found that the coal does extend between these points, its amount must be very large.

The outcrop near Borsora is very favourably situated for being worked. It is not more than half-a-mile within the hills and at a low elevation above the plain. The coal rises from the outcrops so that mines or quarries could be easily drained. The foot of the hills is only 1 mile from the Patlai river, a branch of the Jadukhata, and during the rains boats can come up to within a few hundred yards of the hills.

Even now great numbers go close to the spot during the rains to carry away limestone from the numerous quarries between Borsora and Lakma.

TEA.

THROUGH THE TEA DISTRICTS OF NORTH INDIA.

(*By a Ceylon Planter.*)

NOWGONG, ASSAM.

THE labour for working tea estates in Assam is procured from two sources—the local villages and the cooly districts of Bengal. The former labourers are known as Cacharris, a term which is applied to all local labour. They are generally engaged for short terms only, and receive Rs. 5 and Rs. 6 a month, subject to deductions for non-attendance. This source of labour is a very uncertain one, and the class of men are very untrustworthy. On the occurrence of sickness in the lines, they frequently decamp in a body, to the serious loss and inconvenience of their employers, and any row between one of them and the manager will probably lead to the loss of the whole force. They are, in fact, a most independent race, and it requires great tact to manage them properly.

The Bengal labourer is generally imported under three years' agreements, on the expiry of which term, it is the custom to offer a bonus as an inducement to them to re-engage for a term of years. This labour-supply is the only dependable one in most localities, but the difficulties in the way of procuring it are considerable. It is the usual custom to send native recruiters to the villages, but the restrictions placed by Government on the departure of emigrants, though well-meant, make the difficulties and expense of recruiting very great. In some cases European assistants are sent down to supply the gardens with labour, and the work they have to do is of a most unpleasant nature. The bribery of native officials from the lowest to the highest is a necessary preliminary apparently to securing labour. All proposed immigrants are examined by Government officials regarding their willingness to go, and their fitness for the journey; this, admirable though it no doubt is in theory, and necessary though it may be, adds greatly to the expense and difficulties of recruiting. It is also very generally stated that the local European Government officials do not look on the departure of their ryots, who contribute to the local revenue, and on whom the prosperity of the district depends, with a favourable eye; and it appears that very little help and guidance can be obtained from them. With the police and other native officials, whose power in the case of native recruiters is absolute, bribery is the only possible road to success.

I met one planter in Assam who had been engaged in recruiting labour personally, and who had been treated in the most shameful way in consequence. It appears that he visited the labour districts, and through his native subordinates succeeded in collecting and forwarding the required labour; in doing this it is to be presumed that he hurt the susceptibilities of some native official: for a short time after he arrived at the estate a warrant for his arrest, signed by a European magistrate at the place at which he had been staying, and granted at the instance of a native headman, arrived at the estate, and he was taken back all the way to Bengal. The charge was one of having wrongfully induced a certain labourer, a woman, whose name was mentioned, to leave the district against her will. A lawyer from Calcutta was engaged to defend Mr. B——, and witnesses taken from the Assam garden to Bengal. The case was then proved to be an utterly false and frivolous one, without the smallest foundation, and it was shown that the magistrate had granted a warrant of arrest for a European planter at many hundreds of miles distance, on the mere statement of a petty native headman, unsupported by any trustworthy evidence. The expenses of the case amounted to Rs. 3,000, which the estate had to pay, and no redress was obtained beyond a severe reprimand to the official in question from Government. This case greatly excited public

attention at the time, and is evidence of the unfriendly spirit which is said to be shown by the local official mind to the recruiting of labour.

The cost of importing Bengali labour, greatly increased as it is by the local expenses, is a very serious item in the estimate for tea planting and cultivation. The amount per head varies in different localities, but ranges between Rs. 50 and Rs. 100, in most cases closely approaching the latter figure, and the whole of it unrecoverable. Even at this cost, however, it is impossible, in most cases, for gardens to keep themselves fully supplied with labour, short-handedness being a frequent cause of loss of crop and neglect of proper cultivation. On the expiry of the term for which the labourer has engaged, generally three years, it is the custom to give a "bonus" of Rs. 20 or so to retain his services for a further period. This system has at times led to much ill-feeling and loss, the crimping of time-expired labourers having once been common. A proper understanding on the subject has now been come to in most parts, and crimping, or "inslaving" as it is termed in India, is comparatively rare.

The outbreak of an epidemic, on an abnormally unhealthy season, leading to a large percentage of deaths amongst the coolies means a very serious direct pecuniary loss to the garden beyond what arises from neglected cultivation. All these points, the unreliable character of local labour, the difficulty and expense of importing Bengalis, and the serious loss that an epidemic causes to a garden, make the labour supply, though apparently cheaper, in really dearer and less satisfactory than that of Ceylon.

We are constantly complaining in Ceylon about the forms which we are required to keep in connection with the medical care of coolies; having seen what the Indian Government require of Assam planters in this respect, I cannot but think that we are comparatively easily treated.

I have before me at the present moment a copy of the various forms which have to be kept on the estates, and duplicates of which have to be forwarded to Government. They are nineteen in number!! A *separate* register of imported, local, and free labourers. A register of deaths of contract labourers, adult free labourers, children under 16, adults living in the lines whether on contract or not, and so on, all separate and distinct. Then registers of sick, of vaccination, and of desertion: a daily attendance roll. The monthly return of births and deaths has 60 columns, and there are also half-yearly returns. In fact, returns of labourers are in their infancy in Ceylon. To appreciate the high pitch of development to which red-tape can be brought, Assam must be visited.

Every garden has to keep a native doctor of some kind to attend to the coolies, and groups of gardens in small districts support a European medical man among them: in fact, the cost of medical attendance on coolies is decidedly heavier in Assam than in Ceylon.

One of the chief grievances which planters have against the present labour laws, and the method in which they are enforced, is the great amount of Government interference in all matters between master and labourer. It is the duty of the Commissioner to visit all the gardens in his district, muster the coolies, and make enquiries as to whether they have been paid to date, what their pay is, what tasks they have to perform, what amount of sickness there has been amongst them: in fact, to hear and enquire into any complaints they may have to make.

Of course, when the Commissioner is a sensible man he does his work in such a way as to discourage frivolous complaints on the part of coolies, but the immense power with which he is invested might cause incalculable harm in the hands of an incompetent crotchetty man. Amongst other things, the Commissioner has the power to cancel all cooly agreements, and stop cultivation in a garden under certain circumstances, one of which is a death-rate over seven per cent (epidemics apart), another the coolies' pay being in arrears. When I mentioned that in Ceylon it was usual to have several months' pay in hand, and that the coolies preferred getting two or three months' pay at one time, whilst in some cases financial causes have left them unpaid for a year and over, the statement was received almost with incredulity, and I was told that in Assam such a thing was impossible. The system of paying coolies, and of keeping their accounts, is quite different to ours, and very much simpler in the case of local labour. The sirdar's name is alone entered in the accounts, and against it the total number of coolies who have worked during the month at Rs. 3, Rs. 4, or Rs. 5, as the case may be, and the total sum so arrived at is paid into his hand for distribution. Strange to say, the coolies prefer this system to any other, and attempts to deal with them direct have failed. Imported labourers are differently treated, and more according to the Ceylon system.

Extra plucking is always paid for in cash on the spot, at a very fair rate, generally one pice (¼ anna) per lb. of leaf, the task being ordinary 16 lb. for men and 14 lb. for women; some of the latter of course making considerable sums during the season in this way. The task is in fact very much the same that is usually got in Ceylon, though, of course, it is always varied in accordance with the size and abundance of the flush. The field cultivation is generally carried on by the local labourers, it being a style of work to which they are accustomed, and requiring less skill and practice than plucking and manufacture, which works are mostly performed by the more permanent imported labourers. The hoeing of land is done entirely by task-work, and good coolies will frequently earn double and in some cases almost treble pay in a day. Whilst on this subject I cannot refrain from remarking on the great improvement our decimal system is on the anna and pie system in value in India. With our somewhat elaborate check-roll, the latter system would be most inconvenient. It can scarcely be denied that the close supervision exercised by Government over the imported labourers and their treatment, has had a beneficial effect. It is said that at one time the mortality used to be very great, in spite of the large pecuniary interest planters had in the lives and health of their coolies: this was due chiefly no doubt to the unhealthy state of the country there, but there can be no doubt that the precautions and care exercised by Government have done good.

Another great difficulty in Assam is *transport*. At present goods are carried by cart or boat to the Brahmaputra, and thence transported to Calcutta in flats attached to the steamers. The rates charged by the steamer companies are very high, and make the transport of tea from the gardens to the shipping port from two to four times as much as the average rate in Ceylon. The heaviest charges, however, are on goods taken up to the district against stream; and consequently the cost of lead, nails, boxes, and machinery, &c., is enormously increased. As an example I was told of some roofing iron for a factory which cost £50 at home, and the freight on which from Calcutta to Tezpore amounted to about Rs. 750.

In transport, therefore, as well as in labour, Ceylon has great advantages over Assam at present. At Debroogbur a railway is being made; is partially completed in fact, up through the tea districts, to where a very fine seam of coal is being worked, and there is a talk of this railway being continued in the direction of Calcutta; but the difficulties, rivers principally, seem very great.

The expense and delay of a journey up the river have been already mentioned: a daily service of very fast little steamers is now being started; they carry mails and passengers only, and do the journey from Dhubri to Debroogbur in a comparatively short time.

T. C. OWEN.

—*Ceylon Observer.*]

THE CHEMISTRY OF PACKING.

MR. G. H. WIGNER, F.C.S., F.I.C. (President of the Society of Public Analysts), recently read a paper before the London section of the Society of Chemical Industry, in which he pointed out the importance of proper packing in the case of various substances imported and exported.

Amongst the substances requiring the utmost care in packing he specially mentioned tea, and his remarks on this subject will be read with interest by growers in India and Ceylon.

"Tea," he said, "is remarkably prone to 'acquire' any external odour from the air in which it is placed. It is, of course, well known that tea is always packed in cases which are lined with lead. In the case of China teas the lead is tolerably pure, cast into sheets by pouring the melted metal on to one stone and dropping another stone on the top of it. This primitive method produces a sheet of somewhat singular uniformity in thickness, weighing about 2 lbs. to 3 lbs. to the square foot. Indian teas are packed almost exclusively in lead, which is sent out from this country. It is not pure. It contains an admixture in most cases of tin, and sometimes a small proportion of antimony. These are added to enable the lead to be rolled much thinner, and the weight of it is not more than ½ lb. to the square foot. Before any injury can occur to the tea itself, this lead must either be destroyed or perforated, or, at any rate, it must not be in an air-tight condition. It is obvious that, except in cases of neglect, all such goods would be packed in wood which was at any rate fairly well-seasoned. Until recently only, one kind of wood has been used for packing tea. This is a species known as 'toon' wood, and every one who has ever seen a tea-chest made of it must be familiar with its general characteristics. It is easily worked, does not require to be stacked long to season, is free from smell, and not very liable to absorb water. The cases of injury with this wood have been of only occasional occurrence, and appear to have been determined much more by accidental circumstances than by even an occasional failure in the character of the wood itself. But of late years the supply of 'toon' wood has run short; the Chinese have had resort to other woods, and in Assam woods are being used at random."

The rest of Mr. Wigner's paper was devoted to details of injury to teas, resulting, in his opinion, from the wood of the cases absorbing moisture and causing the lead envelope to be attacked, white-lead being often found in larger or smaller proportion on the wood next to the lead.

TOBACCO.

TOBACCO CULTURE IN VIRGINIA.

(BY C. F. BERKELEY, AMELIA CO., VA.)

THE "Old Virginia Leaf" has probably seen its best days. Whatever were the means by which the staple attained its great reputation, the planters have not troubled themselves to sustain it. Formerly, the facility of raising tobacco through the double advantage of rich soil and cheap labour, with the profit of ready sale, induced all who could to plant as large a surface of the crop as was possible. Complaints, however, as to quality began to be heard sometimes before the war, but were unheeded, and now, while the demand continues steady, the increased cost of producing the weed, and the decline in prices, have borne heavily on the farmers, and their favourite crop is fast losing its place as a paying product.

To secure a crop of tobacco, two things must be assured—a full plant-bed and a full planting. The bed is a spot in the woods, with a southern exposure, cleared off to the required number of square yards, which varies from 500 to 2,000. Great care is necessary in the preparation, the first part of which is burning. This is done to kill all grass-roots, and seeds of weeds, that they may not grow with the plants. Parallel rows of poles (skids) are laid, four feet apart, extending the length of the bed; across these is built a good sized ridge of wood, reaching from side to side, then fired along its whole extent. After burning until the coals and ashes have covered the ground underneath, the fuel is pulled over upon a fresh strip of ground, the process being repeated untill the bed is burned all over. A powerful breaking-plough is used to tear up the plot, followed by grubbing hoes and rakes kept going until the charged stumpy area is turned into a nice soft bed of uniform fineness. It is necessary to put strong manure on the bed to make good plants. The seed is then sown, mixed with dry ashes, at the rate of a gill to the 100 yards, and put in by a brush, a small tooth-rake, or by stamping. Plenty of brush must be put on the bed to protect the young plants from late frosts. Having manured his land, the farmer makes lists (throwing three furrows in one), and cuts them into hills. The best planting time is from the middle of May to July; after this, the cutworm and heat destroy all replanting. After a rain, the plants are drawn from the bed, and dropped by one person, for two others, who make a hole in the hill, insert the root, and press the earth close. The working of the crop is the same as with corn. When the tobacco is high enough to have ten leaves, after pruning, the bud is taken out, to prevent seeding, and the plant grows broader and heavier, but no taller. With the second week in August comes the fly which fastens its white eggs upon the underside of the leaf, from which the worms hatch by hundreds. Unceasing attention for three or four weeks is imperative, to keep down worms and suckers, or they will destroy the crop. Cutting is begun about the middle of September. The plants are split from the top to within six inches of the root, severed, and turned bottom up to "fall," after which they are collected in piles of about a dozen each, and hung by the splits on sticks riven for the purpose. Some farmers cure tobacco on scaffolds in the field, but the rule is to house and fire at once. When the stems are dry enough to crack, the curing is done, and some damp day is chosen, when the tobacco is "in order," to strike and bulk it. Stripping is done during winter.—*American Agriculturist.*

BRITISH WEST INDIAN TOBACCO.—The price of Havannah cigars has advanced so much of late years as to afford great encouragement to competitors, and there is no valid reason, says the *Planters' Gazette*, so far as we are aware, why Jamaica, Trinidad, and other of our West Indian possessions should not grow just as good tobacco and manufacture equally good cigars as the neighbouring Spanish colony, provided always that the same care and experience is devoted to the enterprise. In Jamaica there are already several tobacco plantations, whose produce, both in the raw and manufactured state, finds a satisfactory market in Europe, and Mr. D. Morris has been energetically urging an extension of this amongst other industries there. During the last few days Trinidad has also entered the field with a first shipment of cigars, the results of the experiment, are, we believe, such as to afford encouragement to the proprietor of the plantation, Mr. Charles Fabian, jun., and to his superintendent, Mr. Henry Anderson.

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CONTENTS :

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

CORRESPONDENCE.

TEA BOXES.

TO THE EDITOR.

SIR,—Will you allow me a little space in your columns to give publication to the result of an experiment tried by me on wood used in the manufacture of tea boxes. My attention was first drawn to the subject by an article in the *Indian Agriculturist*, dated 1st of March 1883, from which I learned that some pieces of a tea box which had corroded the lead lining, and destroyed the tea, had been sent to India by Professor Dyer of Kew to be identified. As this is a question of great importance to all interested in tea, I determined to try an experiment with the different kinds of wood used by manufacturers in Silchar, and obtained from each workshop two small boards of each kind, one seasoned and the other green. Between these boards I placed a piece of tea lead, tied them together and put them in an almirah. After two weeks they were opened and examined, with the result that the green board of the wild mango (*Mangifera Sylvatica*) had corroded the lead, the surface exposed to it presenting exactly the appearance described by Professor Dyer—*i.e.*, it was covered by a white coating of carbonate of lead. When held to the light, it presented the appearance of having been perforated with a pin. The surface in contact with the seasoned wood was untouched. From this, it seems pretty evident that the green mango wood contains chemical properties injurious to tea lead, which are either dissipated or otherwise rendered harmless by the process of seasoning. The other kinds of wood had no effect on the lead.

H. J. YOUNG,
Asst. Conservr. of Forests, Cachar Division.

Silchar, October 4, 1883.

THE REVIEWER REVIEWED.

TO THE EDITOR.

SIR,—On the 17th of August last, I learned for the first time that my "Manual of Agriculture for India," had been reviewed in the columns of the *Civil and Military Gazette*. The Editor in his letter of the 15th of August informed me that—"A long review of your 'Manual of Agriculture' has already appeared in the *Civil and Military Gazette*. So far as I remember, the opinions expressed was generally favourable." (Signed), "STEPHEN WHEELER, Editor." This letter was in reply to mine, asking the Editor, if I sent him a copy of the Manual, would he be so good as to review it, pointing out defects, and suggesting improvements, which would appear in the second edition.

On receiving Mr. Wheeler letter, I wrote for a copy of the *Civil and Military Gazette* containing the review, which did not reach my hands till the 25th of September.

The date of this paper, the 3rd of May 1883, attracted my attention, and for the reasons given beneath.

In February Sir Alfred Lyall caused me to be officially informed that, when I received it, I was to forward for his information a copy of my "Manual of Agriculture," and when doing so, to state the nature of the assistance I required, to produce a Hindu translation of the same.

In the latter part of February, and during all March, and up to the 7th April, nearly every overland mail brought me one or more final proof chapters of the Manual, and on the last date, I received, with the chapters, a cover for binding the completed work. On the 8th April, the unbound proofs were made over to a book binder who delivered the bound volume to me on the evening of the 9th April. On that date this was the only copy of the Manual existing in India. On the 10th April, I despatched the volume by Registered Book Post, to the address of Mr. W. Holmes, Private Secretary to his Honor the Lieutenant-Governor of the North-Western Provinces, and in my letter of the same date, I informed him why the book was sent. Mr. Holmes must have received the volume at Lucknow on the 13th of April, and shortly after, by order, he must have made it over to Mr. Benett to peruse and pass his opinion thereon. The abusive and hostile review which appeared in the *Civil and Military Gazette* of the 3rd May must have been written some time in April for it to have appeared so early in May, and as no other copy of the work existed in India, between the 13th and 30th of April, it is reasonable for me to draw the conclusion that if Mr. Benett did not write the review himself, the reviewer was some one who wrote under his instruction, or inspiration. Mr. Wheeler letter, tends to show that he *individually* did not write the review, which contains allusions to certain matters stated in my letter to Mr. Holmes, for the information of Sir Alfred Lyall. Hence it follows that as Mr. Benett

was entrusted with this information, he is either directly or indirectly connected with the authorship of the review in question.

As it may be part of the official duty of the Director of Agriculture, North-Western Provinces, to review scientific agricultural works, and, when convenient, to abuse the author, I trust no objection will be taken to my reviewing a non-scientific agricultural work, which could neither have been printed and published in English, and subsequently translated into Urdu (Hindoostanee), without Mr. Benett's previous sanction and approval. Thus though Mr. J. B. Fuller, B.C.S., Assistant to Mr. Benett, is the reputed author, the latter official is responsible for its publication, at the Government Press, and at the public expense.

To introduce the reader to this official work, * devised for the instruction of the rising generation of agriculturists, it is necessary to make a quotation from the review under notice.

Extract.

"The regeneration of Indian agriculture should be no difficult matter, considering the number of teachers who are ready to come forward and instruct the unenlightened masses. Each, according to his own lights, has adopted a special method for carrying out his object. We have an ultra-scientific *Manual* by Mr. Robertson, of the Madras Saidapet Farms; the absurdities of the *Indian Agriculturist*, the easy and useful *Primer* by Mr. Fuller, of the North-West Provinces, Agricultural Department; and last, but not least, we have a *Manual of Agriculture for India*, by the well-known Lieutenant Pogson."

The London Press, connected with India, having expressed the highest approbation of the *condemned Manual*, and the Lieutenant-Governor of the Punjab having bespoken five hundred copies of its translation into Punjabi, is a rebuff which it is to be hoped will be felt and remembered by the reviewer, who has only to study the Manual with care to comprehend the difference between a practical scientific work on agriculture, and a departmental production, which would never have been printed as it stands had the copy been submitted to Doctor King or the distinguished Superintendent of the Saharunpore Botanical Gardens, who would have pointed out that the cotton flower does not contain *pillars* of different sizes, nor *knobs* of different sizes and forms, nor small *boxes* filled with yellow dust, as stated by the author. The extracts given beneath speak for themselves, and show the value of *the easy and useful Primer.*

Extracts from the "Agricultural Primer," of the North-Western Provinces.

"There is a very great difference between a plant and an animal, but perhaps not more than between some animals and others. The difference for instance between an elephant, and the tiny creatures which swim about in dirty water, is almost as great as between an elephant and a tree.

"Although, then, there are great differences between the common sorts of plants and animals, yet it is extremely difficult to make a rule which shall exactly distinguish between them. Both are alike in *being alive*—that is to say, in being born, existing for a limited time, and dying again; both grow by taking in food from the outside, and altering it, till it becomes in substance like their own bodies." (From First Lesson.) Remarks. An animal is born alive, and has a father, and a mother; a carrot or cabbage seedling is not born and has neither father nor mother, as the seed from which it germinates is not alive. No rule is necessary to distinguish between an elephant, and the *peepul* tree on whose branches it feeds. The ass feeds on thistles, the elephant on sugarcane, and its producer the zemindar does the same, yet according to Cawnpore doctrine, "*it is extremely difficult to make a rule which shall exactly distinguish between them.*"

"By means of these magnifying glasses a flea can be made to look as large as a mouse, and its eyes and even teeth be seen as easily as those of a mouse. When plants were looked at in this way, it was seen that they were made up of little bags, just as an orange is, each bag being filled with liquid. If a piece of plantain stem be cut across, and looked at, a great number of tiny little holes will be seen in it. These are the ends of little tubes which run up and down the stem, and which are believed to be merely rows of bags, with their ends knocked out. The green substance of which the plantain stem is composed, is made of little bags, shaped like bricks, and fitted one to another, like a mass of masonry, through which these little tubes run like water pipes."

* *An Agricultural Primer*, for use in Indian Elementary Schools and Classes. N.-W. Provinces and Oudh Government Press, Allahabad.—Second Lesson, p. 4.

Remarks.—Can such twaddle, about bags, bricks, holes, water pipes, and tubes, which *run up and down* the plantain stem be called instruction in agriculture?

"Just as the root answers to the *mouth* of animals, through which nourishment is taken in, so do the leaves answer to the stomach, in which this nourishment is digested."

"It is in the leaves that the green colour peculiar to plants is chiefly noticeable. It is caused by a vast number of little green balls inside the cells of which the leaf is composed."—Third Lesson, pp. 11 and 12.

Remarks.—Let the reader translate the above into Hindoostanee, and then after reading the translation to a servant, ask him to explain what is meant?

In Lesson IV., pages 13, 14 and 15, the cotton flower is thus described for the instruction of the zemindar's sons:—

"Under the *cup* there are the five yellow leaves, which form the bright yellow flower." "Inside these yellow leaves again you will see a kind of small pillar, covered with little yellow knobs, from the top of which protrudes a knob of different shape and very much larger than the others. Pull off the five yellow flower leaves and split up the centre pillar, with your finger nail, you will see that the little yellow knobs all come off together, being fastened to a strip of whitish coloured skin. This white skin forms a tube, and round another thinner pillar inside it, and you will see that the large top knob belongs to this second pillar, and remains in its place, when all the small knobs have been pulled off together, with the skin they are fastened to. The inside pillar leads down to a roundish mass, which is the unripe cotton pod." "The white skin tube is covered with little knobs, each of these little knobs is a small box filled with yellow dust. They burst when the flower opens, and the dust is scattered about. If you open a fresh flower bud, you will see all the little boxes, as they appear before bursting.—Lesson IV, pp. 14, 15.

"Plants like animals grow by feeding, just as an animal is only able to live, and grow by taking in food; so also without food, plants immediately wither and die; animals can only live on vegetables, or animal food, they cannot subsist on minerals such as stone earth, sulphur or iron. But plants live almost entirely on minerals. The food taken by the plant roots is not so important as that taken in by the leaves. Of the different substances of which a plant is composed, the most important exist in the air, in the shape of a gas, or vapour, mixed with another gas."—Lesson VI, pp. 20, 21.

In Lesson XIV, page 69, the student receives instruction on the subject of dealing with the sterilizing salt called *Reh*, in the N.-W. Provinces, and *Kullur*, in the Punjab.

"In the cold weather, before the rains begin, shallow trenches should be dug, or scooped right across the field at about 2 feet apart, these should all slope towards a pit which should be dug in one corner. It is during the heat of April and May that the *Reh* chiefly comes to the surface, and when the rain falls, it will dissolve, and run down the trenches into the pit. After a month, the pit should be closed with earth, and by degrees in this way, the "*Reh*" can be gradually washed off *Usar* land, and the soil be made capable of cultivation. The reason why, unless this be done, *Usar** land can never improve, is that, each year the rain water carries the *Reh* down into the soil with it, and brings it up again, when it evaporates just like the bucket of a well—up and down, up and down."

At page 67, and in Lesson XIV, the young ryot and zemindar receive instruction on the subject of irrigation. He is told that "the water enables the crops to eat up more food substances than can be prepared for them during the year, by the action of the sun, rain and air on the soil, and the plants are therefore like a man who eats up his whole month's allowance of food in fifteen days, and has to starve for the remainder."

Remarks.—Assuming that there is an ample supply of plant food substances in the soil, *these* are never named by the Author, in any part of his work either from want of knowledge, or studied reticence; it is out of the power of the plant to play the glutton as described. The zemindar floods his land with canal water, which being pure spring and snow water, derived from the Himalayas, dissolves far more plant food (namely, Humic acid, and the phosphates of soda, potash, lime, magnesia and iron) than is needed by the growing crop, and as this solution sinks downwards, by the mere force of gravity, it in time gets beyond the reach of the roots and rootlets of the plants, which suffer not from repletion

* *Usar*, is Sanscrit for naturally *barren* land. Such land is hopelessly barren, and has not been sterilised by *reh*, due to canal irrigation.—J. F. P.

but from the food needed being placed beyond their reach. The water of nearly all wells contains more or less lime, and alkaline and saline matters in solution which act upon the iron and phosphate of lime present in the soil, and so form plant-food. Land under well irrigation cannot be flooded, whilst fields under canal irrigation are flooded at each watering.

The *easy and useful Primer* under review extends over 84 pages, 72 of which bristle with the wonders, and blunders, corresponding to the extracts quoted, and as those are no doubt repeated in the *Urdu* translation (priced at five annas per copy) intended for the use of village schools, it is easy to understand Mr. Nesfield's opinion "that vernacular education in the North-Western Provinces and Oudh Government Schools was utter rubbish, inasmuch as the vast majority of the pupils never remembered anything that they learned." The pupils on their part, may very justly retort, that if the instruction imparted to them was rubbish, the sooner they forgot it the better, and Mr. Nesfield has only to peruse the *Primer*, to be satisfied that it comes under his condemnation, and is not worth remembering.

J. FRED. POGSON.

TEA CULTIVATION IN CEYLON: IMPORTANCE OF SUPERIOR SEED.

(*To the Editor of the Ceylon Observer.*)

SIR,—There can be now little doubt that in the course of a generation our infant industry, tea, will have superseded all other productions in a great degree, and have become the principal export from Ceylon, and it behoves us as the introducers or pioneers of its cultivation, to do all that lies in our power to ensure the success and permanency of the new undertaking. Our planters are proving themselves capable of thorough manipulation in the manufacture of the invigorating leaf, and with the climate we possess to help them conjointly with their agricultural attainments (of no mean order), its production in paying quantities may be taken as an established fact.

But there is one point connected with the cultivation of the many varieties of economic plants that have been and are being grown in this island, which has never received the attention it deserves, and on looking closely into the matter, it seems almost incomprehensible why such an important factor in the typical perpetuation of the species under cultivation should have been so neglected. I allude to the utter want of any attempt on our part to maintain the continuance of reproduction of the species under cultivation on scientific grounds, in such a manner as to ensure that the plants for future clearings shall be, if not actually superior to the parent trees, at any rate their equal, and to reduce the possibility of any deterioration in succeeding generations to a minimum. In fact no pains or trouble should be spared in endeavouring to increase the suitability of the future generations of the tea plant for the use they will be put to.

Now, if we turn to the mother-country, we will find that the attention both agriculturists and horticulturists there pay to this subject, at once shows it to be one of vital importance, and it has by degrees come to be almost a science in itself. No farmer or gardener would for a moment think of obtaining whatever seed he might require, in the haphazard way we do, from any parent stock that appears to be of good quality, for he has found by bitter experience that those qualities are transient, and that his only way was to obtain the seed he required by the *combination of carefully selected varieties of the same stock.* To most, this was a matter of great difficulty; for to be successful, an undivided attention must be paid to the subject, and to meet this difficulty these enormous seed establishments and nursery gardens have sprung up during the past half-century, and that they were requisite has been proved by their success.

It must not be inferred from the foregoing that I am advocating the erection of similar establishments in Ceylon. If tea happened to have been an annual, I believe they would have been found necessary, but what I do feel is required, is that the quality of any seed I might purchase either for myself or my employers should be undoubted, and that there would be no fear of the plants from such seed being inferior to the parent. That a large percentage of the cinchona seed sold in Ceylon during the past few years may be characterized as rubbish, few will gainsay, and a small proportion of tea seed may be classified in the same category. I have been victimized in both quite unwittingly on the part of the seller, and it is for the purpose of endeavouring to commence a movement to counteract this tendency of plants to produce inferior seed that I now write.

The manner in which this desired result is to be obtained, I must leave in abler hands than mine to determine. All I can do at present is to draw attention to the want, and if this want be generally admitted, there is little doubt that a satisfactory solution to the problem will not be long of coming. In the meantime, I would suggest that those who are making small plantations for seed-bearing purposes, should not confine the same to one kind of seed; for instance, if indigenous Assam be required, the parent trees should be from seed from different sources (indigenous), and planted out alternately in equal proportions; if hybrid, they should be composed of different hybrids of the best class, with a few indigenous or China plants through them, according to the elevations for which the seed will be required; this in any case cannot but be beneficial.—Yours faithfully,

SWADDY.

The Indian Agriculturist.

CALCUTTA, NOVEMBER 1, 1883.

INDIAN AGRICULTURAL DEPARTMENTS.

AN English contemporary very recently took occasion to make a very long and elaborate official paper on bee-keeping in India, issued by the Government of Madras, the peg on which to hang a series of criticisms, more or less reflecting on the Government of India. We are not at present specially concerned as to how those criticisms may be met and disposed of by the department concerned, but it seems to us that there is considerable room for men of scientific attainments, in say the *Agricultural Departments* of the various presidencies. We do not for a moment wish to underrate the very eminent Geologists, Palæontologists, Mineralogists, Chemists and Botanists, who are in the service of the Government of India. These eminent men are either absorbed by the Geological Survey or by Government Gardens, maintained for scientific purposes, or otherwise fully occupied, so that little if any of their time is available for work outside the routine of their several duties. We do hold, however, that there is a wide field and a pressing need for trained adepts in the physical sciences being attached to each of the Agricultural Departments of India. We do not say that the Indian Agricultural Departments are distinguished for their knowledge of agriculture either of India or any other country. The method by which appointments are made to these departments renders such a consummation, useless in rare instances, scarcely possible. Apart, however, from the fact that there are few men in the departments who have had a special agricultural training to fit them for the posts they occupy, the usefulness of these departments to the Empire is seriously impaired by the additional fact that, from top to bottom of the departments, imperial and provincial, there is scarcely to be found a man of distinguished scientific attainments. How any Government persuades itself that it is serving the best interests of Indian agriculture, by attempting to carry on an Agricultural Department withoutt he assistance of the most eminent scientific observers it can procure, is a problem totally incomprehensible outside of officialdom. The farmers' co-operative societies of England are able to secure the services, as consulting chemists and botanists, of some of the best known scientific men in England. There is scarcely a State of the American Union, which has not its scientific man, more or less distinguished, attached to its Agricultural Bureau. To say what France, Germany, Italy, and even Australia have done, and are doing, in this direction is to repeat what ought to be well known at all events to those who are supposed to be leaders in agricultural matters in India. Nevertheless, as we have said, the Government Departments of Agriculture are distinguished not for the scientific attainments of their officers, whose reports and notes on agricultural matters ought to bear

with them the highest authority, and be final; but on the contrary, they are characteristic of the commonplace and in some instances of the questionable. It seems to us the height of legislative folly to establish departments which are supposed to deal with technical and scientific subjects, and then subject the reports of these departments to the criticism of provincial Secretaries, who know little or nothing regarding the topics dealt with. If anything could have been devised better fitted to bring Indian Agricultural Departments into contempt, and secure for their labours the least possible amount of usefulness, we shall be glad to learn what it is. As it stands, the department is officered by clever civilians and military men, who, as a rule, though not always, are able to write essays quite as deftly as the other clever civilians, who in the official capacity of Secretaries to Chief Commissioners and Governors, and Lieutenant-Governors revise their work. We venture to think that until men with a training more or less purely scientific, officer, in larger numbers, the Agricultural Departments of India, the departments will scarcely justify their existence. We do not mean men who have distinguished themselves at examinations by exhibitions of brute-like memory of facts and text books; but men who have shown practically that their powers of observation and experiments have been trained and perfected in the field and laboratory. Men of this sort are not to be had every day; whereas men who can cover acres of foolscaps at examinations, and pour out the contents of text-books and lectures, can be had common enough; and the bulk of mankind accept the latter as the pure gold, instead of the hollow tinsel dummies that some of them are. Men of the sort we have indicated as suitable for the work of the Indian Agricultural Department cost money, and money is a consideration of considerable moment. Could there not be fewer of the "writing beggars," and an increase in working, scientific men, not more book crammers?

THE EXTERNAL TRADE OF BENGAL.

The "Report on the External Trade of Bengal with Nepal, Sikkim, and Bhootan for the year 1882-83" has a most imposing appearance, being too tall and too broad for most bookshelves, and bound in the most stiff and uncompromising fashion. It does not, however, contain as much matter as an ordinary newspaper, consisting of thirteen pages only of large type, and it is just possible that the information it contains might have been put into the annual trade report, without much loss except that of diminishing the returns of the Bengal Secretariat Press. The subject is one of interest, however, and we should welcome a separate volume on it, if the excellence of the composition at all corresponded with the admirable appearance which the book presents, when viewed from the outside. If we may be allowed to make a suggestion, it would be that the official gentlemen who write these reports should be required to sign them. They would then, perhaps, take more pains to convey their information in a readable shape, whereas it seems that books "published by the Government of Bengal," without further specification of the author, are intended rather to show obedience to the order that a book should be written on such and such a subject, than to interest or instruct any one.

While glancing at the figures in the report, we sometimes feel inclined to ask, "Is that all true, or only a story?" There are thirty-two registering stations along the Himalayan frontier, all at lonely places, and there is a natural suspicion that the registering clerks may prefer fishing in the hill streams or visiting their friends, to counting carts, bullocks, and coolies as they pass by. Considering the love of the Bengalee for statistics however, we might not hazard the expression of the doubt, were it not for the statement that "the Lieutenant-Governor is unable to accept the figures of the two years previous to 1882-83 as being finally correct, as the result of the enquiries made through the Deputy Commissioner of Julpigorie, under the orders of the Government of India, regarding the shell-lac trade registered in those years, showed that the figures of the trade submitted to Government since 1878-1879 were for the most part fabricated by the registering mohurrirs at Buxa and Ambari stations." We agree that figures should not be accepted as "finally correct," when it has been proved that they are fabricated, and we wonder respectfully at the word "finally" having been used. Is it supposed that a certain correctness should be attributed to all official figures, even when we know them to have been invented by the clerks? The two mohurrirs were found out in consequence of the unusual interest taken by the Indian Government in the subject of shell-lac; and the question arises, were the other thirty immaculate? Had *they* also a power of imagination, a development of the inventive faculty, a gift for dealing with figures, not only in the way of marshalling and arranging, but of positive creation? We notice that the Darjeeling Deputy Commissioner is likely to prove, without knowing it, a patron of this form of original literature. When the line that was at first modestly called the Darjeeling Tramway, and now more magnificently the Trans-Himalayan Railway was opened, and a road made in connection with it to the Jeylap Pass, it was reasonably expected that the facilities thus afforded to trade would lead to its increase. When none followed, the Bengal Government enquired the cause, and the Deputy Commissioner replied, "I dare say that inattention to orders on behalf of the registering clerks, may have affected the returns in the past, but I am doing my best to rouse them, and have, as reported above, only recently thoroughly inspected the stations. Both clerks have been warned and one temporarily suspended, and I hope that no indolence on their part will hide the improvement which I believe to have really set in, in the Thibetan trade." We hope that the two clerks are men of discernment and sterling honesty. If they are ingenious, they will argue that Government having made a road and encouraged a railway, naturally expects an increase in the traffic: failing to show this, we have been "thoroughly inspected by" a Deputy Commissioner, in itself a fearful punishment, and we have been "roused," warned, and one of us "temporarily suspended." This we now see is what happens to registration clerks who do *not* show an increase of traffic, when Government requires it, to justify its new road towards Thibet. For the future, we had better send in returns indicating an increase every month, and then our friends at home will no longer hear of our being inspected, roused, and temporarily suspended, over these desolate Himalayan heights. 'Perhaps if we can ascertain the views which the Lieutenant-Governor is said to have expressed to Lord Ripon, and support them by the right supply of figures, we may get away from the hills altogether, and be put on the more pleasant and profitable work of registering traffic where the Nuddea tolls are collected.' We give this as a possible line of argument of the ingenious clerks who invented the figures as to the trade in shell-lac, and without the slightest insinuation against their comrades at Darjeeling, who, we sincerely hope, are much above entertaining such sentiments.

As to the figures produced, no one can object that they are not sufficiently minute, giving in abundance the details desired by merchants. The total value of horses which crossed the Nepal frontier for British territory was Rs. 1,200; of canes and rattans, one rupee: of precious stones, during the last year, when any came, Rs. 700; of manufactured leather, Rs. 262. These, we can believe it possible were the property of a solitary horseman, on a nag of the average price now asked for the walers imported to Calcutta, carrying a riding cane, a valuable ring, and with a most exaggerated idea of the worth of his boots, saddle, and bridle, as leather. Among the exports to Nepal, we notice Rs. 25 worth of lime and limestone, Rs. 4 worth of bricks, Rs. 11 worth of coal, Rs. 4 of assafœtida, Rs. 36 worth of liquors, Rs. 33 worth of firewood, the total value of the exports under these six heads being Rs. 113. Similarly in the returns of the trade to and from Sikkim and Bhotan, there are a number of items of five rupees and under. Any ordinary traveller crossing the frontier should fill the return with a vast variety of articles as important as those noted. We felt inclined to remark that a great deal of space might have been gained by the judicious grouping of these petty items of trade. But then there may be a difference of opinion as to what constitutes gain of space. To a book-maker anxious to pad an attenuated volume, it is vain to recommend condensation.

The tables appended to the report show that the imports into Bengal from the frontier state of Nepal, were valued at

107 lakhs in 1880-81, and at 82 lakhs in each of the two following years. Our exports to the State have been uniformly valued at 82 to 87 lakhs. The exports to Bhootan have fallen from two lakhs to one, and the imports are represented by nearly the same figures. The exports to Sikkim have increased from something less than one lakh to something more, and the imports from that country have at last reached the figure of two lakhs. The trade with Nepal only is considerable, and our imports seem to be mainly from the country of the plains, the staple being rice. An attempt was made to ascertain the duties levied in Nepal on trade with Bengal, the enquiries not being addressed to the Resident—who is supposed to sleep for eight months of the year at Khatmandoo—but to the Collectors of the districts in our territories. It is the rule with the Bengal Government whenever it wants to learn anything, to ask the Collectors, and they reply to all questions. Sir George Campbell used to keep a stock of such questions as :—What is the average weight of a Patna sheep? What is the consumption of tobacco per head of population in this province? What is the percentage of polygamous Hindoos in your district, to those with one wife? And it was supposed that he would make an interesting book out of the answers given by the Collectors, when he had time to reconcile them. We observe that the Collectors have very readily furnished tabular statements of the duties levied in Nepal, but that they do not in the slightest degree accord. The Collector of Chumparun says, there is an *ad valorem* rate; the Collector of Mozufferpore that the duty is levied on the land irrespective of its value; and his brother of Darjeeling supports him in this, but gives double the rate. This applies to rice, but in no one item can any possible agreement be found. Perhaps the duty may be left to the discretion of local officers, but the Bengal Government seems to incline to the belief that the reports are 'inaccurate,' to put it mildly.

EDITORIAL NOTES.

In acknowledging the annual report on the production of Cotton in the Central Provinces, the officiating Secretary, Mr. A. H. L. Fraser, says :—"I am also to state that the Chief Commissioner is unable to accept the estimate of 100lbs. per acre even for the Wurdha district. In Berar, where it has been possible to ascertain the amount of the out-turn with almost mathematical accuracy, the out-turn is much less; and Mr. Jones does not think that in a province in which cotton is so unequally distributed very safe results can be obtained on the method adopted in paragraph 6. It seems to the Chief Commissioner probable that the chief source of the error which you notice is to be found in the Wurdha estimate of 30lbs. In this district the acrerage under is more than one-third of the total acreage under cotton cotton in the province, so that any error in the estimated out-turn of this district produces an immense error in the estimate of total production. This Wurdha estimate is probably, notwithstanding the badness of the season, as much under the mark as the estimate of 100lbs. would be above it. If we raise Wurdha to 50lbs., and similarly raise some of the other districts in which the out-turn is obviously too low, the facts of the year will be explained. The remark made by you that a wet year is a bad year for cotton is entirely in accord with Mr. Jones's experience.

"The value of the cotton crops according to your returns, which are certainly too low, is put down at over 47 lakhs. It would not perhaps be very unsafe to raise it to nearly 60 lakhs, that is to say, that it equals the whole land revenue of the province. In the Wurdha district the value of this crop far exceeds the land revenue.

"I am to add that in future reports information should be given regarding the presses and mills at work in the province; and statistics showing the exports of the principal exporting stations would also be of some interest."

Such an eminent authority as Sir J. B. Lawes is doubtful as to the feeling value of ensilage, and he thinks the loss of nutritive matter in the silo is so large as to make it unprofitable as an auxiliary to British farming. Mr. Woods, on the other hand, in narrating the results of his experience, dwelt on the value of ensilage as a succulent food for milch cows and ewes, and he illustrated this by giving figures showing a marked improvement in the quantity of milk and the quality of cream yielded by cows fed on the new fodder. The analysis he obtained of the ensilage also showed it to be a succulent, highly nutritious, and easily-digested food. A different result has, however, attended experiments in Canada, conducted by Professor Brown during the past season at the Ontario Agricultural College and Experimental Farm. These showed that ensilaged corn fodder gave 15 per cent less milk, 30 per cent less butter, and a poorer marketable butter in colour than when the cows got Swedish turnips. Although the animals ate the ensilage readily to begin with, they gradually tired of it and fell off in condition, until other food had to be added.

Mr. Woods' testimony as to the merits of ensilage, however, receives strong practical corroboration from the official report of the United States Department of Agriculture. This report embodies the experience of about 100 agriculturists in the United States and Canada, and in reply to a schedule of questions submitted to them they express themselves as having no doubt of the profitableness of ensilage. The condition of the stock eating the fodder was uniformly good, both as regards health and gain in weight. Milch cows are more generally fed with ensilage in America than any other class of stock, and it is in this connection that it is expected to prove of greatest service, the majority of the correspondents stating that there is a decided increase in quantity and improvement in quality of milk and butter from cows fed on ensilage. The quantity of fodder given to each cow in the States varies from 50 to 60lbs. daily, in addition to some dry fodder and grain.

The common practice in America, and we believe it is the one which, under general circumstances, it will be best to adopt, is to place the crops in the silo when their full growth has been reached, and before ripening begins. In the United States most farmers favour fine cutting, a half inch or less, as it packs closer, and is likely to keep better; but if stored whole, and firmly compressed, it has been found to keep very well. The fodder should be kept level during the process of filling the silo, and be well trodden. In nearly all the answers to Commissioner Loring's queries, it is stated that the loss by decay, on the silo being opened, was very slight, and confined to the top and sides, where there was more or less exposure to air; and generally it had kept perfectly well for several months, and showed no deterioration.

After all, however, the important point is how far this new method of preserving fodder is suited to the peculiar conditions of this country. American experience will not settle that question to the satisfaction of British agriculturists, and, therefore the results of the experiments at present being carried out will be anxiously awaited. Should they confirm the hopes that have been held out—and in the light of what has already transpired, there is as yet no reason to doubt it—a fresh impetus will be given to agriculture, and the farmer, will be fortified in no small degree in contending with the difficulties of a severe winter.

Experiments on the temperature of the soil are being carried on at the Houghton Farm, New York. The soil is a gravel. with a clayey sub-soil, and uncropped. Thermometers are fastened in the hollow ends of wooden rods, and these are placed at different depths below the surface, in closely fitting zinc tubes filled with water. The thermometers were placed at the following depths: Surface, 3 inches, 6 inches, 9 inches, 1 foot, 3 feet, 5 feet and 8 feet, and are read hourly from 7 A.M. to 8 P.M., from the first of May to the first of November. Hourly, daily, and monthly variations of the temperature were observed. The first are confined to the upper layer of soil, and are often sudden and violent. They may be caused by the shifting of the wind, clearing of a cloudy sky, a thunderstorm &c. There is a great daily range caused by absorption of heat by day and radiation at night. The range is much reduced by cloudy or rainy weather. These daily variations take place to a depth of a foot or more. The maximum temperature at the surface is about midday and the minimum shortly after

midnight. These extremes are later at successive depths, until at 1 foot they are retarded eight to ten hours, presenting the curious feature of the one-foot thermometer rising while the surface one is falling, and *vice versa*. There is a constant rise in the temperature of the soil, beginning in the spring, easily observed to a depth of eight feet. Storms and cold weather check this advance temporarily. Below three feet there was an unbroken rise from May 22 to September 1. The mean temperatures for six months—May to October, were: Surface, 66·40: 3 inches 65·30: 5 inches, 65·30; 9 inches, 65·30; 1 foot, 64·20; 3 feet, 62·80; 5 feet, 58·60; 8 feet, 55·80. At a depth of 8 feet the mean temperature was only 10·60 lower than at the surface. During the autumn there is a zone of subsoil below one foot, which is warmer than the soil above it, and this prolongs the season.

SOME trials have, it seems, been recently made by the Veterinary Instructor in British Burmah in view to testing in the case of rinderpest and anthrax the efficacy of the lymph prepared by M. Pasteur, who is experimenting in animal inoculation in Europe. On the 7th September last two cow calves, a buffalo calf, two sheep, a large elephant, a young elephant, a pony and a pig were inoculated with what M. Pasteur terms first vaccine for anthrax fever: the temperature of the animals was, with one exception, very little affected by the vaccination. The second lymph was infused on the 23rd September, but again in this case with little apparent effect. At no time were any of the animals off their feed. The prophylactic effects of vaccination with M. Pasteur's lymph were also tested to see whether it would prove effective in rendering animals proof against an attack of rinderpest. Some cases of the disease were found, and the three calves, which had previously been experimented on, were removed to the spot and again inoculated with virus taken from the body of a true case of rinderpest. The animals were inoculated more than once, and although they were herded with some cows that were recovering from a recent attack of rinderpest, they escaped without showing any sign of infection. The calves were, after a few months, taken to another spot and placed among a herd of cattle suffering from a severe outbreak of rinderpest, and were inoculated with fluid taken from the intestines and with blood from the bodies of animals showing unmistakable signs of acute rinderpest, yet the disease was not conveyed to the calves. The Veterinary Instructor, in reporting the above facts, said that it would be premature as yet to offer any opinion as to the preventive value of this system of treatment, and has been authorized to continue the experiments. The Deputy Commissary General intends having the mules under his charge vaccinated, and the Bombay-Burmah Trading Corporation, are, it is believed, going to resort to vaccination extensively in connection with their elephants at Mingyan and in the Chindwin valley forests, where they have sustained very heavy losses amongst their elephants from what they consider to be anthrax fever.

A WRITER in the *Breeder's Gazette* mentions a cross made on his father's farm many years ago, for which he claims the very best results in producing good milkers with the Short-horn form. The foundation upon which this cross was made, consisted of Red Polled cows, these being bred to a Jersey bull excellent results were obtained so far as milk was concerned, but in form the offspring of this cross partook somewhat of the hollow form of the Jersey. To remedy this defect, these heifers were in their turn bred to a good Short-horn bull. The result was a great improvement in form, while the improvement in the quality of milk was retained. The cows resulting from this double cross are thus described by the writer: "All became marked alike, red and white patches, with large white shield on the forehead. The body long, with wide hips and well arched ribs, heavy hind-quarters, but light fore-quarters; very short legged, but very weighty animals; large bags, producing very rich and creamy milk. When required, a bull was selected from one of the best cows in milk and shape, and in this way the stock was kept up until my father's death." * * * * "The cows were always in good condition and ready when dry to put up for feeding. They as well as the steers were equally ready for feeding and took on flesh very rapidly."

WE heard a good deal some two years ago of the steps taken in British Burmah to develope tobacco cultivation there. One Deputy Commissioner visited the hills, where the Karens are said to grow the finest description of the weed, but to fail miserably in curing it according to Western tastes. He smoked a good deal on his trip, drew his travelling allowances, we presume, and wrote a *couleur de rose* report on all he had seen. A plantation was started near Rangoon, and people were to be induced to bring there all the leaf they could grow, to be cured on the American plan. Instructions were to be given, moreover, to ensure the best varieties only being cultivated. It was thought that as the steam rice mills had encouraged the cultivation of paddy, by purchasing for cash all that agriculturists or boatmen would bring to their mills, so a factory or plantation prepared to purchase whatever leaf was brought to it for cash, would largely stimulate the planting of tobacco. Has the project failed, that we hear so little about tobacco in Burmah at present? The local press is silent on the subject, and good Burmah cigars are as difficult to get as they ever were.

The public both in and outside of Burmah would be glad to hear something of the results of its experiments in tobacco cultivation and curing, of which we were led to expect so much. What has been the result of the experiments, and what money have they cost? The wisest and cheapest plan in the end might be to offer a handsome premium for the first shipment of really marketable tobacco or cheroots, as has been done in Australia and New Zealand with other produce. The result of such bonuses in the colonies has been to establish several important new industries. We are not saying that the attempt of the Local Government has failed, but we should like to know something of the results of the experiments made.

"NOTWITHSTANDING the fine stores of timber which exist in many parts of the Indian tea districts, but a very small number of estates utilize them for the supply of tea chests. The importance of having thoroughly well-seasoned wood for this purpose is obvious, and has always been insisted on; but it seems very strange that amongst the numerous species in the Indian forests, none should be found sufficiently suitable to come into universal use. I met one Assam planter who has sawmills and who goes in for supplying estates with chests, but this kind of enterprise seems quite the exception. As a rule, tea chests are made of teak from Burmah, which must be very expensive when the excessive cost of transport up to Assam is considered. Teak makes very good boxes no doubt, but I feel sure that good suitable wood could be found in India for the purpose. In Ceylon, there has been some discussion on the subject, but the difficulty appears to have been overcome, as all estates use local woods. The tree which I have found most suitable is mallebodde, *if properly treated*, and therein lies the secret. It is light, inodorous, and holds a nail well. It is liable to the attacks of insects, but it seasons very quickly, and, if used as soon as ready, makes capital boxes. Many other woods are well-adapted to the purpose, and are used by the companies who supply chests in Colombo; but mallebodde is found in almost every locality where tea is grown, and hence, its suitability for the purpose in question is a matter of importance. The seasoned hal chests now advertised by the ceylon company are very cheap, and, for estates situated near a railway station, preferable to boxes made on the spot, but for plantations with long road transport the importance of having a suitable wood near at hand is great."

A WELL known Scotch farmer has lately been conducting a series of interesting experiments in ensilage, in connection with the Highland and Agricultural Society. He has two silos, each 30 feet long by 12 wide, inside measurement, and 13 feet from the floor to the pillars, which, again, are about 5 feet high, and support a light roof of wood covered with felt. The silos, which cost £70 each, are built into a bank, so that "while the top of the solid wall at one end is level with the ground, the floor

at the other end is level with the ground there." This allows the green stuff to be shot out of the carts without difficulty, while it also facilitates the withdrawal of ensilage from a door at the lower end. The floor, walls, and pillars are formed of concrete, the walls being from 12 to 14 inches thick; the doors are formed of boards fitting closely together, so as to exclude the air and retain the moisture. Grass that had been in the silo for three weeks had a strong, slightly alcoholic smell, and was brown in colour, but on being offered to horses, together with sun-dried hay, it was instantly preferred. The pressing down of the stuff is the most difficult part of the work connected with ensilage. The process first adopted was to trample it down, and then to cover it with boxes loaded with stones and gravel. The better plan, however, was to use half-barrels, filled with water by a hose and emptied, when required, by a siphon. It was suggested, however, that a more satisfactory method still would be to employ cast-iron cisterns or vats filled with water, as these could be made to fit closely into the silo, and be raised and lowered at will by means of pullies. The object of the experiments in Scotland is to determine whether the silos can be relied upon to provide, in all sorts of weather, succulent and palatable feeding for the ewes in spring from vetches, clover, natural grass, and green crops, thus rendering the farmers independent of turnip fodder, which is both expensive and precarious.

PROFESSOR WRIGHTSON, of the College of Agriculture, Downton, Salisbury, writing on root crops or corn crops, says:— It has generally been considered that 150lbs. of roots are required to make 1lb. of beef or mutton, and according to a consensus of opinion of good Scotch agriculturists a ton of roots will ordinarily be converted by a fatting animal into one stone of 14lbs. of butcher's meat. When meat was worth 7½d. per lb., a ton of roots would, according to their independent but mutually confirmatory estimates, be worth 8s. 9d., and a crop of 20 tons per acre would be worth £8 15s., or, allowing 10 per cent for waste, £7 17s. 6d. per acre. If we compare this estimate with a corresponding good crop of wheat, which we may take at 40 bushels, then at the old estimate of 7s. per bushel, the wheat crop was worth £14 per acre, and discounting this as in the case of the root crop by 10 per cent, £12 12s. per acre.

The relative values of the two crops, therefore, might be supposed to stand as follows:—20 tons of roots at 8s. 9d. per ton, less 10 per cent for waste, £7 17s. 6d. per acre; 40 bushels of wheat at 7s. per bushel, less 10 per cent. for waste, £12 12s.; difference in favour of the wheat crop, £4 14s. 6d.

Turning to the present values of the two crops, we find that one ton of roots according to the above statistics is worth 11s. 8d. per ton, and 20 tons are worth £11 13s. 4d. Discounting this as in the former case by 10 per cent, the value of an acre of good roots will be found to be £10 9s. 10d. But the value of our 40 bushels of wheat has gone down to 5s per bushel or to £10 per acre, and if this is discounted at 10 per cent, for the sake of comparison, to £9 per acre. The relative values of the two crops have therefore completely changed, as will be seen by the following statement:—20 tons of roots at 11s. 8d. per ton, less 10 per cent for waste, £10 9s. 10d. per acre; 40 bushels of wheat at 5s. per bushel, less 10 per cent for waste, £9; difference in favour of the root crop, £1 9s. 10d.

Not only is this the case gauged by the ordinary prices of beef and corn, but farmers who are alive to the superior value of improved animals for breeding purposes will be able to take their turnips to a better market than the shambles. England enjoys a monopoly with regard to improved breeds of cattle and sheep, and all countries send to her to recruit and improve their herds. It is not likely that this will cease to be the case, as there is something in the English climate particularly favourable for the development of high-class domesticated animals, and the tendency is ever towards depreciation after they leave our shores. No such relief is to be found for wheat growers. Here we are beaten in quality, so that many corn dealers will not buy English grown wheat at all, and in any case 5s. to 5s. 6d per bushel is the absolute limit of price. If then, we wish to know the possible value of root and fodder crops as well as of grass, we must take into account possibilities in the direction of breeding animals that will be in demand for breeding purposes. It is not for a moment proposed that corn-growing should be given up. It appears to be a necessity of our system of farming, for if land is folded with sheep too frequently it becomes 'stained,' and the intervening corn crop serves to sweeten it. But it would be no small gain if the farming public could be made to see that those crops which have hitherto been regarded as supplemental and as mere preparations for corn crops are now really the important crops, and that it is in reality more according to fact for us to look upon the corn crops as the accessories—as the preparation for roots, purifiers of land for sheep feeding, and sources of straw for litter. Clay lands will probably be more and more generally laid away to grass, but the lighter classes of land suitable for turnips and fodder crops will continue under the plough. It is in the case of such lands that the relative esteem in which corn and root crops are held requires to be re-adjusted. The point I have attempted to bring out is simply this—that the old notion that root crops are grown at a direct loss, and chiefly as a preparation for grain crops, is calculated to promote a false system of agriculture and ought to be reversed and abandoned.

ON all sides, says the *Journal of the Society of Arts*, complaints are heard of the serious consequences of the destruction of the forests of the world, and reports arrive of the attempts that are being made to improve the present condition of forestry. Delegates from various parts of the United States were present at a Forestry Congress lately held in St. Pauls, Minnesota. The President, in his opening address, stated that in Ohio, Maine, New York, and other States, the acreage of forests was constantly increasing. In some States an "arbor" day had been instituted, and in these the increase was notable. The forest acreage of the United States, however, was less than one-fourth of the total surface, a smaller proportion than in the east, west, and north of Europe. At the present rate of consumption the supply of pinewood in the Northern States would be exhausted in a few years. Forestry is taught in the State Agricultural College at Lansing in Michigan State, which is said to contain a good labelled arboretum and a large collection of native and exotic trees under cultivation. The last Legislature of New York State passed a law to encourage tree-planting, by which any inhabitant who shall transplant by the side of a public highway adjoining his premises any forest shade trees, fruit trees, ornamental trees, or any nut-bearing trees, shall be allowed, in abatement of his highway tax, one dollar for every four trees set out. Elms must be placed not less than seventy feet apart, on the same side of such highway, and no maples or other forest trees, ornamental, or fruit trees, nearer than forty feet apart on the same side of such highway.

In Mexico, the Government has contracted with Mr. Oscar A. Droege to plant 2,000,000 trees in the Valley of Mexico, within four years from March 15, 1881, or 500,000 trees a year in such places as the Government shall choose. The contractor pledges himself to establish a number of nurseries, and to have in them each year at least 800,000 ash, 35,000 willows, 120,000 poplars, 60,000 eucalyptus, 60,000 mountain cypress, cedars, 60,000 acacias, and 180,000 of other trees. The trees are to be in plantations of from 50,000 to 100,000 each, and Mr. Droege must maintain them for two years after the planting. Three graduates of the School of Agriculture are to be received into the nurseries each year, there to study the science of forestry. Mr. Droege is to raise fruit and other useful trees for distribution, and he is to receive annually $10,000 (£8,500), till the sum reaches a total of $200,000 (£42,500). A work on arboriculture, of recognised merit, is to be translated from the German every year in order to disseminate sound views on the subject among the students and the public.

In Europe the Forestry Schools are now very numerous, and the following list of those in Austria and Germany has lately been compiled:—Austria heads the list with nine schools—*viz.*, the Imperial High School of Agriculture and Forestry at Vienna, with six professors and 329 students; the Eulenberg School, with six professors and fifty students, the course lasting two years; the Weisswasser School, with five professors and eighty students; the Lemberg School, with twelve professors and forty students; the Aggsbach School, near Melk, with two

professors and twenty-four students; the course of forestry in the technical high school of Gratz; the Styria Forest Culture School, with three professors and twenty-six students; the Carinthia School; the Vorarlberg School. Prussia has three institutions, commencing with the Royal Forest Academy at Neustadt-Eberswalde, with a director, fourteen professors, and other assistants. The course is two and-a-half years, and the number of students about fifty-seven. The Munden Royal Forest Academy has a director, ten professors, and seventy-eight students. The Forestry School at Grosse-Schonebeck and the forestry courses to the Army Forestry Battalion are for the training of lower forestry officials. At the former school are four professors; at the latter eleven, all of them practical foresters. Saxony has a Forestry Academy at Tharand, with ten professors and assistants. In Wurtemburg instruction is given at the Royal Agricultural Academy at Hohenheim and at the University of Tubingen. In Baden the forestry department of the Carlsruhe Polytechnic has forty students. Bavaria has a forest academy at Aschaffenburg, with a director and seven professors, in addition to which are six chairs of forestry in the University of Munich; Hesse-Darmstadt has a forestry institution attached to the University of Giessen; and Saxe-Weimar has possessed one since 1808, with a director and four professors. No other countries can equal this extensive list, but France has her famous school of forestry at Nancy, and one of forest guards at Barres, in addition to several agricultural schools and agronomic industrial schools, in which forestry is taught. Russia has four schools—*viz.*, the Agricultural and Forestral Academy at Petrovsk, near Moscow; the Agronomic Institute at St. Petersburg, with courses in sylviculture; the Forest School at Lissino, and the Forest Division of the Agricultural Institute at New Alexandra. There is an Italian school of forestry at Vallombrosa; a Danish school, attached to the Royal Veterinary and Agricultural College at Copenhagen; and a Swedish forest institute at Stockholm, besides thirteen private elementary schools. In Switzerland the department of forestry forms the fifth division of the Federal Polytechnic School at Zurich, in which are thirty students.

A Spanish School of forest engineering exists at San Lorenzo del Escurial, near Madrid. The British Consul at Malaga reports that the cultivation of the eucalyptus has of late attracted considerable attention in that province, which has been deprived of all but fruit trees in order to supply the constant demand for charcoal, caused by the extensive use of this fuel for cooking purposes. Large numbers of the eucalyptus, in a healthy and flourishing state, may now be seen along the line of railway from Malaga to Bobadilla, and in other places, and they are reported to have been effective to some extent in destroying fevers in the low districts, formerly uninhabitable. These trees are also successfully used to form avenues, and afford protection from the sun on the roads near the city.

Alone, among the great countries of Europe, Great Britain is without any adequate means for the teaching of forestry, and in order to remedy this state of things the Council of the Society of Arts memorialised the Secretary of State for India. (See *Journal*, vol. xxx., p. 879.) It was suggested that by the addition of special means of teaching forest cultivation and cognate subjects at certain of the large educational establishments of the country, such as that at Cooper's-hill, the existing system of sending forest students to Continental schools might be superseded. Last month Sir John Lubbock also drew the attention of the Government to the subject of forest education in Committee of Supply.

MR. W. COOK, of West Chislehurst, writing in *Poultry*, says:—I am often asked what the cause is of fowls laying shell-less eggs. There are several causes. I may mention three. First, from the fowls having been kept short of materials to form or make the shell. If this is allowed to go unnoticed, it is a great strain upon the fowl's system, and has a tendency to weaken the oviduct, or egg passage, where the egg is encased with shell. Secondly, from laying double-yoked eggs. This also injures the passage very much at times. I have known fowls, after producing several of these large eggs, never lay perfect-shelled ones again, while others are left very weak, and only lay them with a very thin shell, not sufficiently thick for hatching purposes. In such cases as these, hens ought to be allowed to sit, so that the whole system has an entire rest; when this is done, it proves a certain cure to them, and strengthens the fowls very much. The third cause is when a fowl produces eggs so rapidly that three eggs may be found in the oviduct at once. The middle one is forced down on the one that will be laid first; the third, following again quickly after the second, forces the middle one out of the part of the oviduct where the shell is formed on them.

THE following are extracts from an article which appears in the *East Anglian Handbook* for the present year, from the pen of Mr. R. B. Sapwell, describing the system pursued in the rearing of turkeys in Norfolk:—

Considerable difference of opinion exists as to the best age for the stock birds. Undoubtedly a two or three-year-old gobbler, and hens from two to four years old, would give the strongest and best stock; but I find the disadvantages arising from keeping old birds so great that I almost always fatten my stock birds and bring up young birds for the next season, saving only especial favourites for a second year. The advantages, I believe, gained from using young birds are that the eggs produce a larger number of gobblers than from older birds, and these are much more valuable than hens, and I find young hens commence to lay ten days or a fortnight before older birds. The young gobblers are not so savage as the older ones, and fewer hens are injured and killed by them.

Hen turkeys generally lay about twenty eggs. It is a good plan to set the first eggs under hens, giving the turkeys about fifteen of their own eggs to sit upon. It is an unwise, as well as a cruel, plan to set all the turkeys' eggs under hens, and make her lay all the season. Late-hatched turkeys never thrive as the early birds do, and they never grow to a size to realize a profitable price. The turkey's services are lost to her own offspring, for turkeys rear their own young much better than hens do, and it almost invariably happens that a turkey becomes so debilitated by laying all the spring that she wastes away and dies in moulting. The time when turkeys require the greatest care is until they are six weeks old, when the young cocks begin to show a little red on their heads. Dryness is of the first importance; large, roomy coops, with covered runs, are desirable, that the young birds be not allowed to roam about in wet weather, or when the dew is on the grass.

The food for the newly-hatched birds should be principally hard-boiled egg, with dandelion, lettuce, onions, or nettles chopped up, with a little bread-crumbs; to this may be added a little rice boiled in skim milk (if quite sweet), a little suet or greaves, and in wet and cold weather a little cayenne pepper, with grain of all sorts as the birds grow older. A fresh site for the coop every morning is a *sine quâ non*, and a little exercise if the mother is a turkey—but not if she is a fussy old hen—is also advantageous as the chicks get on. A good sign is to see the young turkeys catching flies. In order to get fresh, untainted ground, it is a good plan to hurdle off a part of a field —a new ley, if handy, for the coops, and the grass should be kept mown closely to the ground.

Turkeys will take to any young turkeys, whether hatched by themselves or not; so when our young birds get fairly strong, we generally transfer those hatched under hens to the turkeys. One has to be careful that the chicks do not perch on the rails of the hurdles or the tops of the coops; crooked breasts would be the inevitable result; they should be induced to sit on the ground as long as possible, and then taught to perch in low bushes and trees, and until they are shut up for fattening they are better never to have entered the fowl-house. Having reached the age of two or three months, June has arrived, and the birds are perfectly hardy, requiring little care, but generous feeding. A more economical food is now desirable, and barley-meal, with, perhaps, a little scrapcake, maize, barley, and small wheat, is the usual food.

Turkeys for Christmas should be shut up in a light, dry roomy house the first week in November; troughs with as much maize and good barley as they can eat should be always by them, with two good meals a day of just as much barley-meal, mixed with flat milk, as they can eat, and milk to drink

Sliced mangel, turnips and swedes, and cabbage are useful and necessary, and plenty of sand, lime, ashes, and brick-dust should be in the corners of their house. Let the troughs be well cleaned every morning, all surplus food removed; on a farm there are plenty of other fowls glad to clean up after turkeys. In conclusion, let me strongly advise my readers never to make birds of their own breeding with one another; every year let them purchase a new bird for stock, unless they retain the old bird and are not using hens of his breeding. There is no economy in buying a cheap bird; a few shillings extra expense about the gobbler will probably be a matter of three or four pounds weight in each young turkey next year.

TWENTY-ONE years ago, says a writer in the *Farmers' Review*, Congress gave each State public lands to the extent of 30,000 acres for each member of Congress, senators and representatives included, according to the census of 1860, for, in the language of the Act, the "endowment, support and maintenance of at least one college, where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts." This Act originated with Hon. Justin S. Morrill, of Vermont. Before entering upon public life he was a merchant and farmer in Strafford, the town of his nativity, where he came into close contact and profound sympathy with the agricultural and working classes of the people. Being a man of native shrewdness and great common sense, with an aptness for public discourse, he easily became a leading man in the community, and entered Congress about 1856, if our memory is not seriously in error. His intensely practical and patriotic turn of mind suggested this eminently wise use of the national public domain, then and since so lavishly, if not recklessly, bestowed upon projected railroads. Many remember the various plans adopted by the different States in disposing of the proceeds of these grants. That many mistakes were made is true, and it could not be otherwise, and that some of these colleges are following more or less defective policies to-day is true. But with all these errors, our serious thought is one of wonder and gratitude that the errors are so few and limited in their baneful influence.

There lie before the writer the catalogues and connected reports of three of these colleges—those of Massachusetts at Amherst; New York, the Cornell College at Ithaca, and Kansas at Manhattan. These colleges may be taken as representatives of that class of schools in the land. Cornell, most wealthy and ablest manned of them all, stands among our agricultural colleges very much as Harvard, Yale, and John Hopkin's University do among the classical schools of the country. Amherst represents those which seek to combine the classics, agriculture, and the mechanic arts especially, those relating to manufactures. This latter feature is worked or taught in Boston as a portion of the land grant was bestowed on the Institute of Technology a school whose specialty is in this line. The Kansas College is almost wholly "practical," agriculture, manufactures, telegraphy, printing, and the allied sciences; no Greek or Latin is mentioned as belonging to its curriculum. At Cornell there are some four or five general courses of study, those of art, of literature, of philosophy and of science, and these are sub-divided into as many as ten special courses of four years each, so that the student who wishes to pursue a course purely agricultural, finds a full four years of such study laid out with classes pursuing it. Or, if he wishes the mechanical arts or architecture, or civil engineering, or chemistry, or other special courses, he finds them. The Massachusetts College, partly from more limited resources and partly from the traditions of New England, has a less varied course and one more strongly marked by its classical features, though giving thorough instruction in agriculture and the mechanic arts. The Kansas School fairly represents the earnest, vigorous, pushing and "practical" spirit of our western civilisation. That it really represents the popular sentiment of the people may be seen from the fact that on its catalogue last year were enrolled 347 names. Amherst had 110 students, but among them were two specialists, one from Brazil and one from England. Cornell had 410 students, a large number of whom were pursuing special and post-graduate studies, while the field of its patronage embraced Brazil and Japan, as well as nearly or quite every State in the Union.

THE wild plantain it seems is not found in the Kistana, Nellore, Bellary, Anantapur, Chingleput, North Arcot, South Arcot' Salem and Trichinopoly Districts; it is believed to exist on the Nallamalai Hills in Kurnool; it is found in small quantities in the forest uplands of Ganjam and on the Anaimalai Hills in Coimbatore, and very sparingly in the sholahs and by the rivers and streams of all the forests of the Periyakulam range in the Madura district. On the Western Ghâts of Malabar it is widely distributed, but is by no means abundant; there are large quantities in the Rayngadda and Jeypore tracts of Vizagapatam and in the Rumpa, Rékapalle, and other uplands of the Godávari; the ghats of South Canara could supply from 15,000 to 20,000 trees a year: it is found on the hills of Tinnevelly, but not abundantly. The reports from the Nilgiris are conflicting, they are three in number; in the first the Collector, after consultation with gentlemen settled in different parts of the hills, concluded that the wild plantain "did not grow in the Nilgiri district in any considerable quantity"; the next report forwarded by the Collector was from Colonel Jago, the Deputy Conservator of Forests, who stated that the wild plantain "grew abundantly in the vicinity of Devála and Cherambâdi, in the south-east Wynaad, and on the slopes below Thiamalai and Nunjappa Rao's estate on the Kartary side; the third report, that of the head Assistant-Collector, confirmed that of Colonel Jago in saying that the wild plantain "grew in great abundance on all the slopes of the ghats between Wynaad and Malabar, and was found in great quantity on all the estates lying on the edge of the Wynaad plateau."

THE following letter from Mr. W. R. Robertson, to the Director of Revenue Settlement and Agriculture, may be interesting:—I have the honor to reply to paragraph 4 of the Board's Resolution, No. 1334, of the 14th May. In the United States of America, the desirability of extracting the oil of cotton-seed has long been recognized, and experiments in extracting the oil were instituted as early as 1826; but it was not until 30 years later, when experiments were made by first decorticating the seed and pressing the kernels only, that any really satisfactory results were obtained. Previously, experiments had been made with the whole seed, and from the lint adhering to the seed absorbing so much of the oil, it was found almost impossible to remove enough oil to make the undertaking profitable. At the present time, the extraction of cotton oil affords employment to many very extensive, fully-equipped manufactories, engaged solely in the industry. The following extracts from a report by Mr. Sypher, an American authority on the question, affords full information regarding cotton-seed manufactories and the processes followed in the extraction and preparation of the cotton-seed oil:—

"A proper mill for the manufacture of oil and oil-cake from cotton-seed should consist of a substantial building having three and-a-half stories and basement, one hundred feet long by forty to fifty wide. The engine should have power in proportion to the proposed capacity of the factory—twenty horse-power, if two pairs of five-box hydraulic presses are used. The hydraulic presses must be placed on a firm foundation, carefully laid. Heaters and rollers are machines made by the same machinists that supply the presses and pumps. Of hullers—the machines that bear the same relation to oil that gins do to lint—there are two or three patterns that will do the work, though the best, because it is least liable to get out of order and has a much greater capacity than the others, is one invented by Abram J. Sypher, for some time an Engineer in the United States Navy. This machine is in its appearance, in its operation, and manner of receiving seed, somewhat similar to a wheat thresher. The seed is delivered into the huller by an endless canvas apron; it passes under a cylinder revolving at great speed, armed with steel blades, and surrounded about two-third's way by a concave box also armed with corresponding

knives. As the seed is forced between these, the pericarp or hull, is broken and forced from the kernel. The mass of crushed seed then falls into a great revolving sieve. The kernels, many of which are broken into fine pieces, pass through the meshes of the wire sieve, and the pericarp, to which the lint adheres, is carried away and delivered into the fire-room, where it is burned under the boilers and affords a full supply of good fuel for the use of the establishment. The clean seed is now carried by means of a system of elevators to the attic-story, and then passes down into the crushers or rollers. These consists chiefly of two rollers revolving towards each other with unequal velocity so geared as to produce both a crushing and a tearing effect upon the seed. The meal, as the seed is now called, falls to the bin on the first floor, and is shovelled into the heater by the pressman's attendant. The heater is a short, double cylinder, so arranged as to heat the meal in the inner cylinder by steam, which circulates in the space between the inner and the outer walls. Here the meal is heated until the water is converted into steam and escapes; the hot meal is then placed in wedge-shape bags, made of woollen duck; these are placed in hair books, which slide into the boxes of the press. As soon as the pressman has filled all the books, the pump is set working and the tremendous power of the hydraulic press soon forces out the liquid oil in warm, gushing streams. Seven minutes up, and the press returns; the books are thrown out, the duck bags are stripped from the meal, now pressed into solid cakes, the cakes are set up in racks to dry, and thus the operation is completed.

"From the seed which was thrown into the huller, two merchantable articles are produced at the press—crude cotton-seed oil and cotton-seed cake. After the oil has cooled down to atmospheric temperature, and the floating impurities have separated from it and settled to the bottom of the tank, it is of a deep red color, and weighs about seven and-a-half pounds to the gallon. This quality of oil found a market among oil refiners, who, usually by very simple processes, removed the mechanical impurities and destroyed the coloring matter so as to produce an oil of a rich olive color, sweet and agreeable to the taste. Much of this found its way to the tables of our first-class hotels and private families. As a substitute for olive oil, it has no equal, and when flavoured by the addition of genuine olive, it is much superior to any other adulteration yet produced. The chief consumers of the cotton-seed oil, however, are the soap-makers. The oil was purchased by manufacturer in its crude state, and from it was produced almost every grade of soap, from the cheapest family to pure white Castile and the finest and most highly perfumed toilet soaps.

* * * * *

"The refining process is simple, and, after a little practice, may be successfully conducted by any one possessed of ordinary skill. The agent employed to remove the impurities is a solution of the soda ash of commerce, having a strength of about 30 degrees The oil is put into a large metal tank, supplied with steam pipes for heating, and with proper apparatus to keep the oil thoroughly agitated. The caustic solution and the oil, when mixed, should be at the temperature of the atmosphere in the factory. and about one gallon of the solution should be put into ten gallons of oil, mixed small quantities, at intervals of a few minutes. The mixture should then be slowly heated up to 100 degrees, then allowed to cool. During the pouring in of the solution, and while the mixture is being heated, and until the temperature has gone down nearly to its natural state, the stirring apparatus should be kept in motion. The oil should then be left in the tank at least 24 hours that the impurities may settle to the bottom; then, by a faucet inserted at a distance of several inches from the bottom, the refined oil may be drawn into a wooden tank placed in the basement, where it will sink to a still lower temperature, and deposit a purer sediment in the bottom of the tank. If the process has been conducted with care, the refined oil will be perfectly clear, and of a rich olive color. The price of this quality of oil before the war rated at from sixty to seventy-five cents per gallon.

"The ground seed, from which the oil has been expressed, is known to commerce as 'cotton-seed cake,' and is consumed principally in feeding cattle. It is classed by general feeders with linseed cake, though chemists and scientific dairymen claim for it a superiority. When fed to milch cows, it increases the quantity and improves the quality of the milk; it is a rapid flesh former, and the manure of the stock yard where cotton-seed meal is fed is of a very superior quality."

I thought that a small experiment in the extraction of the oil of cotton-seed might be instituted at the Farm with advantage, and I accordingly had an experiment made, the results of which are shown in the enclosed statement. The seed used was New Orleans; it is somewhat larger than the seed of indigenous cotton, but is similarly covered by adhering lint. I forward samples of New Orleans cotton-seed and indigenous cotton-seed. To get rid of the husk with its adhering lint, the seed was crushed in an ordinary bean mill and sifted; the mill not being adapted to the purpose, the process was tedious and slow; for decorticating the 170 lb. of cotton-seed, the cost amounted to 15 annas and 8 pies—about 9 annas and 3 pies per 100 lb. of cotton-seed—a high cost, but it must be remembered that the work was novel to the workmen, while the decorticating arrangements were imperfect. One hundred pounds of cotton-seed yielded 34 lb. of decorticated seed. An oil mill not being available at the farm, one was hired, and the hire that had to be paid was at least double the usual rate. One hundred pounds of the decorticated seed yielded at the rate of 4 measures and 7 ollocks or 16 lb. and 15 oz. of oil, and 71 lb. of oil-cake. The expenses were as below:—

	Rs. A. P.	Rs. A. P.
170 lb. of cotton-seed at 50lb. per rupee ...		3 6 5
Expenses of decorticating the seed		0 15 8
Hire of the oil mill, with cattle, labor, &c. ...		0 14 0
		5 4 1
Deduct value of 29 lb. 4 oz. of oil-cake at Rs. 10 per candy ...	0 9 4	
107½ lb. of husk at Rs. 4 per candy	0 13 9	
		1 7 1
		3 13 0

Thus the net cost of the oil, of which there was two measures—6 lb. 15 oz.—from 170 lb. of cotton-seed, was Rs. 1-11-6 per viss, which is much beyond its value; however, as I have already pointed out, it could not have been expected that the experiment would be commercially successful. The results, however, show that the extraction of the oil is quite feasible, after the seed has been decorticated, and I have no doubt but that with suitable machinery and arrangements, the oil can be extracted at a sufficiently low price to enable it to compete in the market with other oils. I forward samples of the oil-cake and oil; the former contains much oil which a hydraulic press would remove. The oil, it will be noticed, is unrefined. In the United States, 1 ton of cotton-seed is said to produce 35 gallons of oil and 750 lb. of oil-cake. In the experiment just recorded, the outturn per ton of seed was only 10 gallons of oil and 395 lb. of cake; it is evident, therefore, that a considerable proportion of the kernels of the seed was, in the Farm experiment, removed with the husks.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Meeting was held on Wednesday, the 26th September 1883.

W. H. Cogswell, Esq., President, in the Chair.

The proceedings of the last meeting held on the 29th of August were read and confirmed.

The following gentlemen, proposed at the last meeting, were elected ordinary members:—

Mr. M. N. McLeod, Pipra Factory, Chumparun.
Baboo Radhika Prosad Mookerjee, District Engineer, 24-Pergunnahs.
The Manager, Rangli-Rangliot Tea Company, Darjeeling.
Mr. C. B. Mackenzie, Gajilliduba Tea Estate.
Mr. A. Ross, Shahadad.

The names of the following gentlemen were submitted as desirous of joining the society :—

General Azimuddin Khan, Rampore State, *vid* Moradabad,—proposed by R. Dacy Spedding, Esq., C.S., seconded by Major D. G. Pitcher, B.S.C.

The Manager, Bowreah Company Cotton Mills, Limited,—proposed by the President, seconded by J. C. Murray, Esq.

The Manager, Fort Gloster Jute Manufacturing Company, Limited,—proposed by the President, seconded by J. C. Murray, Esq.

Rejoined.—Mr. F. Farquharson, Noonmattee Tea Estate, Assam.

CONTRIBUTIONS.

Indian Forester, vol. IX., No. 9. From the Editor.

Review of the Forest Administration, 1881-82. From Government of India.

Memoirs of the Geological Survey of India, vol. XIX., part 4, and series XIII. From Government of India.

Records of the Geological Survey of India, vol. XVI., part 3. From Government of India.

Annual Statement of the Sea-borne Trade of the Bengal Presidency, 1882-83, vol. I. From Government of Bengal.

The *Implement and Machinery Review*, vol. IX., No. 100. From Proprietors.

The Journal of the Royal Asiatic Society, Bombay Branch, No. XLI., vol. XVI., 1882-83. From the Society.

Report on Indian Wheat by Messrs. McDougall Brothers. From Government of India.

Report of Saharunpore and Mussoorie Botanical Gardens, ending 31st March 1883. From Superintendent, Government Press, N.-W. Provinces and Oudh.

Aperçu sur la Theorie de l' Evolution, by Dr. Ladislau Netts.

Report of the Council of the Acclimatization Society of Queensland for the year 1882. From the Secretary.

A quantity of Aster Seed, French and China. From C. Nickels, Esq., Jounpore.

About 20 lbs. of Maize Seed, from the Cape per *Rautenbern*, Captain Crudace. From S. R. Elson, Esq. The thanks of the Society were voted for the above contributions.

COMMUNICATIONS.

Early Amber Sorghum.

Mr. Helps, of Rangli-Rangliot, writing on the 17th and 25th September, says that the early amber cane, sown in May and June, is from 5 to 7 feet high, but not thicker than his little finger ; it is in full flower, and has much the appearance of the "jowar" grown in the Punjab. Mr. Helps goes on to say :—

'I shall be very glad to give the "sorghum" seed another trial, and I think if sown a month earlier will be a greater success than what I put down this year.

'The "sorghum" seed you sent me last May I put out at two different times, end of May and beginning of June, the success of the first sowing inducing me to try the second, but, most unfortunately, a day or two after the second sowing very heavy rain came on, and washed nearly all the seed away, besides doing a deal of damage to the young plants I had up from the first sowing ; the plants were only a few inches high and delicate, but by sowing a month earlier I think they would be strong enough to resist any rain. I, moreover, think that it is the proper season of year for sowing the seed here, judging from the way the first came up so well. My difficulty will be in getting the cane pressed, for there are no mills in these parts, but I will do my best, and if I can manage it, I will get a carpenter to make me a rough one just to try and make "goor" and "rab" as you wish ; but I should like to have a few instructions sent me as to how it is done, as I have no idea myself.* I noticed the cane contained a deal of saccharine matter. Elevation at which grown is, I think, about 4,500 to 4,600 feet.

'This is a very good elevation for potatoes, and they grow well here : so if you have any good seed I would not mind trying a few maunds if you could send them up. I would send you part of the crop, if successful.'

Herbert Finch, Esq., Mewnah Estate, Shajehanpore, in a letter, dated 17th September, says :—

'The early amber sugarcane seed you sent me was sown on 15th July, and is now seven feet high and in seed. The quantity is too small to admit of any practical experiment as to its value for producing sugar, but the rapidity of its growth would alone make it of value as an intermediate fodder crop for elephants and cattle. Experiments made with very small quantities of seed are practically useless. It would take some four maunds of cane to make a boiling, the result of which could be depended on. If you will send me four or five pounds of the seed, I will sow it in March next.'

A few lbs. of seed have been sent to Mr. Finch for trial.

From Kouer Jai Narain Singh, Didwary, Moradnugger, 23rd September :—

'The proper season for sowing the early amber sugar-cane appears to be during the months of May and June, for then the crop would come up along with the country Sugar-cane in November and December, which is the proper time for pressing the juice. I will, however, sow a small plot of ground just now to see if the plants come to maturity in December or January, in which case a second crop can be obtained.

'Captain J. F. Pogson supplied me with the seed I sowed in March last, and the canes became fit for pressing in June, which was done by means of a *Behea* sugarcane Mill, but as the weather was extremely hot, the juice did not crystallize and produce saccharine matter sufficient to form into sugar.

"As you have now been good enough to supply me with a large quantity of seed, I will try my best to give it the fullest trial possible, and communicate to you in detail the result of my success or otherwise.' Captain Pogson, writing on this subject under date 6th September, says :—

"In my letter, I asked you to send me a sample of the "broom corn," in order that I might ascertain what it really was. I see our common "bajra" is in America called "pearl Millet." The "doora" turns out to be a new or unknown variety of "jowar" (*holcussorghum*), and I strongly suspect the "early amber sugar-cane" is the "Impee," or Chinese sugar sorghum improved by cultivation.

'I think it would be a good plan for the Council of the Society to sanction an indent being made on China for all varieties of sugar-producing sorghums.

'Johnston says :—" In China under the name of 'sugar-cane of the north,' a species of sorghum is cultivated for the extraction of sugar. This plant was introduced into France by M. Vilmorin, who states from his experiments that it is capable of yielding, on an average, from an acre of land 26,000 pounds of juice, containing from 10 to 13 per cent of sugar, and that this is more than the average yield of the sugar beet. It is alleged, however, that the plant is adapted to only a few parts of the south of France."

'I believe the far-famed sugar-candy of China is made from the sugar obtained from this variety of sugar sorghum, which may be a very superior variety of "impee."

'The Chinese are not given to parting with these best varieties of seeds at once, and I dare say the "impee," obtained over 40 years ago, was a common kind. The mere fact of the true sugar sorghum coming from the North of China, shows that it is an inland plant, grown in a cool or cold climate. Our knowledge on the subject is very scanty, and should be increased, and it would be a great point gained if the Chinese method of making sorghum sugar and sugarcandy was ascertained.

'At the Cawnpore Farm, the "early amber cane" gave an "intensely acid" juice, and pot extract or "goor" to correspond.'

The Secretary, in reply to Captain Pogson, drew his attention to the proceedings of the Board of Revenue, Madras, in which Mr. Robertson, the Superintendent of Government Farms, says of the Minnesota early amber sugarcane :—" This is a variety of sorghum which originated in the State of Indiana in 1860, from a plant which appeared in a crop of Chinese sorghum. The seed of this plant was sown, and the produce again sown, which, having been repeated for several years, a large quantity of the seed has been produced."

Captain Pogson's suggestion was approved of, and the Secretary was instructed to put himself in communication on the subject with any correspondent the Society may have in China.

MESEMBRYANTHEMUM CRYSTALLIAMUM.

From Major S. S. Jacob, dated Jeypore, 1st September :—

"In the *Scientific American*, dated 21st July 1883, a notice appears of the above plant, that M. Herve Mangon had observed that it takes up from the soil an extraordinary quantity of alkaline salts, and that he had proposed to employ it for removing excess of salts from land on the sea coast, and in salty deserts, so as to make the land gradually fit for ordinary vegetation.

"I write to ask if you have information about this plant, and if it has not been tried in India, to suggest to the Agri-Horticultural Society the advisability of getting some of the seed and distributing it for trial in this country, especially in the districts where *reh* lands occur.

"I shall be happy to give it a trial if I can be suplied with some seed."

In his reply to Major Jacob, the Secretary mentioned that the *M. Crystalliamum* is the 'ice plant,' so called in consequence of every part of the plant being covered with small watery pustules, which glisten in the sun like fragments of ice. Large quantities of this plant are collected in the Canaries, and burnt, the ashes being sent to Spain for the use of glass-makers (Lindley and Moore). *Mesembryanthenum Crystalliamum* in Spain and *M. Copticum* and *Nodiflorum* in Egypt, are collected for the purpose of furnishing alkali for glass-works : the former is called Barilla Moradeva by the Spaniards, who import large quantities of its ashes from the Canaries, where the seed is eaten as a common food, according to Broussonet (Lindley, Vegetable Kingdom.) *M. Nodiflorum* is used at the Cape in making morocco leather (Simmons). Major Jacob's attention was drawn to the *salsola* plant, which has some of the same properties as the *Mesembryanthemum*. The Secretary was directed to endeavour to procure some seed of both plants.

RICHARD BLECHYNDEN, Junior,
Deputy Secretary.

OFFICIAL PAPERS.

ANNUAL REPORT OF THE ROYAL BOTANIC GARDEN, CALCUTTA, FOR THE YEAR 1882-83.

THE past year has seen the completion of most of the improvements in the garden grounds which were sketched out by me for the approval and sanction of Government in the year 1874. It may therefore not be out of place to give here a short *résumé* of what has been done, for during the nine years that have elapsed since these proposals were submitted, the garden has been practically re-made. The whole extent of the grounds has been raised in level, the necessary soil having been obtained from large sheets of ornamental water which have been cut out. These artificial

lakes have been connected with each other by underground pipes, and a steam pump has been supplied, by which the water in the whole system can be kept at a high level by means of water pumped up from the river. Numerous wide roads have been made all through the garden, so that carriages may now be driven through every part of it. This is an improvement which is much appreciated, as the old restriction to driving acted to a great extent as a deterrent to visitors. Numerous foot-paths have also been made. The bamboo-and-mat erections, which used to do duty as conservatories, have been replaced by three large, handsome, and efficient structures of iron, on which a thin thatch of grass is spread, and under shelter of which tropical plants thrive admirably. The valuable collection of dried plants has been suitably housed in a handsome building designed by Mr. E. J. Martin, the Government Architect, the internal arrangements of which are to a considerable extent adapted from those of the new Herbarium building at Kew. New propagating houses, tool, and potting-sheds have been erected, and good dwelling-houses have been built for the members of the garden establishment, both European and native. A boundary wall and ditch have been partly built round the garden; and, finally, attempts at landscape effects have been made in the gardens, the collections have been increased by considerable accessions of plants, both indigenous and exotic. The collections still, however, require strengthening in many important respects, and certain minor improvements still remain to be carried out before the garden is in the condition I should like to see it.

2. The garden still remains comparatively inaccessible to the public, and there can be no doubt the number of visitors would be largely increased were it connected with the new road recently made by the Port Commissioners along the river bank between the bridge at Howrah and Shalimar. At present this new road ends at Shalimar, and the end of it is not even connected with the old road to the garden, through Seebpore, so that for a visitor to this garden or to the Engineering College the new road is not only useless, but misleading.

3. *Economic Plants.*—Attention has been given during the year to various economic plants. The Ceara rubber tree has been propagated and distributed to a considerable extent. This species grows quickly and thrives well. It is, however, rather easily blown down or broken by the wind, especially during wet weather. The seedlings of the Zanzibar rubber plant (*Landolphia*), for the introduction of which we are indebted to Sir John Kirk, are growing rapidly, and this species appears to have found a congenial home in Lower Bengal. Mahogany seedlings continue in steady demand. The paper mulberry (*Broussonetia papyrifera*) grows wonderfully well, and I am trying to obtain the seed in large quantity from Europe so as to be able to spread its cultivation in India. A few small plants of the species of *Cinnamon* yielding the Cassia bark of commerce were received during the year from Mr. Ford, of the Botanic Garden, Hong-Kong. I regret to say that these do not promise to thrive very well here. Every care is, however, being taken of them. The food-plant known as the Soy bean has been a good deal written about lately, and its cultivation has been pressed on people in this country. More in obedience to the loudness of this clamour than from a belief in its soundness, I have arranged for a supply of Soy beans from Japan, and I propose to distribute these pretty extensively for trial.

4. *Fibrous Plants.*—During the year the utilization of various fibrous plants has received my attention. At the request of Sir Walter DeSouza, permission was given to Mons. A. Berthet, of Rouen, to erect in the garden his patent machine for cleaning rhea and other fibres. This machine was set up and worked under the supervision of a French mechanic sent out by Mons. Berthet. It was driven by the garden engine, and fibre-yielding plants of every kind available were tried in it. The machine is primarily adapted for rhea, which fibre, as also Agave, it cleans admirably. For plantain fibre it is less suitable, but with certain alterations it might be adapted to that fibre. For *Hibiscus tiliaceus*, a common Sunderband plant, which I tried in it, it is also not quite suitable. The machine is beautifully simple, and I have little doubt its ingenious inventor, were he to give his mind to the subject, would have no difficulty in contriving simple and cheap machines adapted to any native fibre which on trial may prove suitable as a raw material for paper, or for cloth, or rope. The experience of the past year confirms me in the belief that plantain fibre will one day come largely into use in India as a raw material for paper; and as plantain stems and leaves are at present absolutely waste, the utilization would be a gain to the country. In several former reports I have referred to the leaves known by the vernacular name *bhabur* as the produce of *Eriophorum comosum*. I have now satisfied myself that the bulk of the *bhabur* used by natives for rope-making is not derived from *Eriophorum* as I had supposed, but from *Andropogon involutus*. This grass, I find from enquiry locally made, abounds in the hill parts of Behar and Chota Nagpore, where it is known as *Sabai*. From these regions it can be obtained in quite considerable enough quantity to make its utilisation as a paper material a feasible project. And the people who actually collect it sell it at a reasonable enough rate. But in order to get it brought to Calcutta in sufficient quantity for local manufacture, or for shipment to Europe, middlemen have to be employed, whose ideas of profit are pitched so high that, until they become modified, the utilisation of *bhabur* must remain in abeyance. This is only in accord with the common experience in the mofussil, that competition in trade is not sufficiently keen to have much effect in keeping down prices, but that, on the contrary, traders still form guilds banded together to enhance prices, even at the risk of cooking off demand.

5. *Introduction of Gourami Fish.*—Through the kindness of the Hon'ble H. S. Thomas, of the Madras Civil Service, one of the garden tanks has been stocked with fry of this excellent Chinese fish. Should this species be found to thrive in Bengal, I propose, with the sanction of Government, to make use of the various ornamental lakes in the garden as breeding grounds, so that fry may be raised for distribution to all parts of the country. The expense of arranging this would be extremely small, and could easily be covered by making a small charge for the fry.

6. *Herbarium.*—Since my last report the new building for the Herbarium has been completed and made over to me by the Public Works Department. This structure, being built on open flue arches 7 feet high, is well raised above the ground, and ought to be perfectly dry. Internally it contains a single room, 115 feet long by 44 feet broad. Round the sides and ends of this room there runs, at 11 feet from the ground, a continuous gallery 15 feet wide. The gallery is connected with the floor by three spiral staircases, and the two sides of it are connected with each other at the middle by a bridge, which affords a means of communication between the two sides without the necessity of going round by the ends. Except the fittings of the doors and windows, which are of wood, the building is composed of masonry and iron. It is therefore practically fire-proof. The Herbarium and Library have been removed to this building, and the short experience I have had of it leads me to believe that it is well adapted in every way for its purpose. The old building in which the collections were previously accommodated (in addition to its other faults) was hopelessly small, and in it the collections were so crowded that it was difficult to consult them. Moreover, a considerable proportion of the collections, which it was absolutely impossible to find room for within it, had to be accommodated in my own house. In the new building there is ample space, and by the purchase of 24 new cabinets it has been easy to arrange the whole collections, so that they may be consulted with facility and comfort. The additions to the collections themselves during the year have been considerable. From the Malayan Peninsula, Herr Kunstler has sent a number of valuable and excellently prepared specimens; from Dr. George Watt, lately on special duty in Munnipore, I have received a set of specimens illustrating the Flora of that most interesting frontier country. Mr. J. S. Gamble has contributed a number of dried plants from the northern parts of the Madras presidency, and Mr. W. A. Talbot, of the Forest Department, has sent a number of fine plants from North Canara. Mr. J. Marshall Woodrow, of the Botanic Garden at Poona, has sent some interesting specimens of Deccan plants. Dr. Schlich, Inspector-General of Forests, and Mr. Hope, late of Dehra Dhoon, have sent interesting contributions from Northern India. To Dr. Treub, Director of the Botanic Garden of the Dutch Government in Java, I am indebted for some specimens of rare oaks, laurels, and figs; and I have to thank Dr. J. Anderson, F.R.S., Superintendent of the Indian Museum, for an interesting collection of Mergui plants gathered during a visit made by him to that province. A considerable number of specimens were also brought together by native collectors whom I despatched to the higher Sikkim Himalaya.

7. *Interchange of Plants and Seeds.*—The issues of living plants were 29,483, as against 23,939 last year. Packets of seeds to the number of 5,224 were also despatched, as against 3,303 last year. These plants and seeds were for the most part given to magistrates for planting in stations and along roads; to superintendents of hospitals, jails, and educational institutions, and to municipalities. On the other hand, there were received, from various contributors in this and other countries, 9,796 living plants and 883 packets of seeds. Chief among the contributors have been Sir J. D. Hooker, K.C.S.I., C.B., R.F.S., &c., of the Royal Garden, Kew; the Directors of the Botanic Gardens in Ceylon, Demerara, Jamaica, Hong-Kong, Natal, and Singapore. Beautiful collections of Malayan plants have been sent from the Malayan Peninsula by Mr. Kunstler, and of Andaman plants from Mr. E. H. Man of the Andaman Commission. The garden has been, during the past as in former years, indebted to the kindness of Messrs. Apcar and Company for free freight on many packages of plants and seeds received from the Malayan Archipelago and from China.

8. The Herbarium has throughout the year been in charge of Mr. L. J. K Brace, who has worked with much energy and enthusiasm. The removal of the collections from the old to the new building was carried through by him without damage to a single specimen. During the year Mr. J. Craig filled the office of Curator of the garden; but since the close of the year he has been dismissed for misconduct. The Assistant Curator, Mr. G. Urquhart, conducted his duties throughout the year to my satisfaction: as also did the native overseer Baboo Prosunno Coomar Sein, and the head malees in the several departments.

9. The budget allotment for the year was Rs. 70,350, and the whole of it was spent. The receipts from sale of surplus plants were Rs. 1,404-10-6, which sum was paid into the treasury.

10. *Lloyd Botanic Garden, Darjeeling.*—In my last report I stated that this garden was being preyed upon by myriads of cockchafer grubs. During the year now under review these creatures continued their depredations until they killed pretty nearly every plant the garden contained. This grub feeds on the fine rootlets by which plants absorb their nourishment from the soil, and only such plants escape as send their rootlets deeper into the soil than it cares to penetrate. The whole of the grass in the garden and all herbaceous plants rapidly succumbed to its ravages, as did many of the flowering shrubs, only the deeper rooting shrubs and trees being spared. Even the plants in the conservatories did not altogether escape; eggs of the insect having got in considerable numbers into the soil of the pots. This grub is not new to the district. It is often found in soil near the sites of old grazing stations in the forest, and it not unfrequently does damage to native crops in the neighbourhood of these. The cockchafer, of which it is the grub, appears thus to affect manure. And there is little doubt that the abundance of the grub in the Darjeeling garden is due to the fact that the whole of the hill above the

garden is saturated with the sweepings and filth of the station, which the municipality continued, in spite of many protests, to bury there for long after the garden was formed. The alterations on the top of the hill, necessary for the preparation of the site for the Eden Sanitarium, were also a fruitful cause of injury to the garden. Heaps of loose *débris* were shot over the side of the hill from the hospital site, and during the past two years quantities of this *débris* have occasionally rushed down the steep slopes above the garden, carrying a proportion of the municipal manure with them and spreading themselves over large pieces of the garden. Mr. Jaffrey, the Curator of the garden, made vigorous efforts to conquer the grub, and about six millions were collected and destroyed by the garden labourers under his supervision. This plague now shows signs of disappearing; and as suitable means are at last being taken to prevent further slips from the hospital hill, the prospects of the garden for the year now entered upon are therefore decidedly brighter. The acclimatized English potatoes produced in the garden last year were largely distributed in the district for seed, and it is believed that the quality of potatoes in the district generally has, by these means, been to some extent improved. The budget allotment of this garden for the year was Rs. 8,830, the whole of which was spent. The receipts, Rs. 355-4-3, were paid in as Government revenue. Mr. Jaffrey has worked with much energy and pluck under disheartening circumstances, and he is now beginning to re-plant the denuded flower-beds and grassy slopes which two years ago looked so pretty.

NOTE ON THE CULTIVATION OF SUGARCANE AND THE MANUFACTURE OF SUGAR IN ASSAM.

(*By the Director of Agriculture.*)

A.—The Brahmaputra Valley.

THE varieties of sugarcane in the valley of the Brahmaputra are not numerous, and may be ranked as follows in the order of their importance:—

1. *Bagi* (white) or *mugi* and *mag* (amber-coloured).
2. *Rangi* (red), *kali* (black), or *teliya* (*i.e.*, the colour of newly-expressed mustard-oil).
3. *Bengal* or *Bombay* cane.
4. *Malaha* and *magara* or *megala*.

The two first kinds are regarded by the natives as indigenous. They are commonly grown together, either intermixed at random, or with red cane disposed round the edges of the field as a protection of the more valuable yellow cane against the depredation of men and animals. A well-cultivated field of *mugi* stands about seven feet in height, and the canes measure a little more than an inch in diameter at the thickest part; the colour is an amber yellow, and the texture soft and juicy. The *teliya*, on the other hand, is hard and thin, of a deep red colour, often passing into a dark shade of purple, whence its name *kali*, or black; and the average dimensions of the stalk do not exceed five or six feet in length by three-quarters of an inch in diameter. These two varieties of cane are more largely grown than any other, the *mag* being recommended by its superior qualities as a sugar-producer, while the hardiness and unattractiveness of the *teliya* render it well adapted for the careless style of cultivation which is affected by the Assamese ryot.

The cane called *bangala* appears to have been brought from Bengal, either at the time of Captain Welsh's expedition in 1793-94 (as is the tradition in Nowgong), or by European sugar-growers in Kamrup some thirty years ago. In the Mangaldai sub-division, where it is said to be of very recent introduction, and also in North Lakhimpur, this cane is called by the alternative name of *bambo* or *bam*, implying a doubtful connection with Bombay. This foreign variety of cane greatly excels the Assamese in size and juiciness; but as a sugar-producer it generally ranks below the indigenous *mugi*. Like the country cane, it is divided into yellow (*pura*) and red (*teli*); the former, which is much the commoner, is a large soft cane, with stalks averaging eight feet in height and an inch and a half in thickness, while the latter is said in the Mangaldai sub-division to be even larger and more juicy. The Bengal cane is grown chiefly in the southern part of Kamrup, in the Mangaldai sub-division, in Sibsagar, and, it is said, in North Lakhimpur. Elsewhere it is cultivated as a garden plant, in tiny patches of *basti* land close by the ryot's dwelling, and is eaten in the raw state after being slightly heated to increase its sweetness, or the juice is used as a syrup in compounding medicinal pills. Though yielding much more juice than country cane, the Bengal kind is apt to break into small pieces in crushing, and thus gives more trash to the mill. A degenerate variety is known by the name of *asamiya puri* in Kamrup, and *ketki puri* in Upper Assam.

The *mahla* or *malaha* cane of Kamrup and Durrung, so called from its resemblance to a kind of reed of the same name, and the *magara* or *megala* of Upper Assam, are a hard and thin variety of the country *mugi*, and, where grown at all, they are planted round the edges of the field, or intermixed with the *mugi*, by chance. This cane, like the *teliya*, is so hard and dry that it may safely be left to protect itself against man and beast.

Two local varieties of cane appear to be peculiar to the Mangaldai sub-division, namely, the *bhabeli*, resembling *mugi*, but with shorter intervals between the joints, and the *kamrangi*, a cross between *mugi* and *teliya*. The former is used for medicinal purposes only (chiefly in disorders of the kidneys), and the latter is not intentionally grown at all.

A light loamy soil, with a slight admixture of sand, is the most suitable for sugarcane. The Assamese name for this kind of soil, *mobulia*, denotes at once the waxy consistence of the loam (*mo* meaning wax) and the addition of sand (*bali*). The land must be high-lying (*bam*) and beyond the reach of inundations. Favourite spots are the edges of a marsh, or the banks of rivers, which in an alluvial country tend to raise themselves above the level of the plain. In Nowgong and Kamrup the sloping plain at the foot of the southern hills furnishes good sites for cane, especially in the neighbourhood of streams, and it is in such places that the Bengal cane of Kamrup is chiefly grown. Gravelly or sandy soils will not produce sugar-cane, while rich alluvial land gives a luxuriant crop, but with watery juice. The degree of manuring depends entirely upon the ryot's means and inclination. Lands in the vicinity of stations are freely manured with cow-dung and crushed mustard-seed, both before and after planting; on the other hand, a field in the jungle often receives no manure except the ashes of the grass and weeds raked out of the soil and burnt. On the whole, cane-lands are not nearly so well manured in Assam as in Upper India. In Goalpara it is said that the spot usually selected is the site of an old cattle-shed, but this can be true only of sugarcane cultivation on *basti* or homestead land, which forms but a small proportion of the whole.

The best cane is grown either on virgin soil or on old fallow; but land from which a crop of mustard, pulse, or summer rice (*ahu*) has been taken is often preferred as being of less laborious tillage. The exhausting nature of the crop is expressed by the proverbial saying that *athia* (a kind of plantain), *kathia* (rice seedlings), and *gathia* (the knotty crop, *i.e.*, cane) destroy the productive powers of the soil. A second crop of cane, unless ratooned, is never grown in the year next following the first, and though two or three years' fallowing is considered sufficient in the vicinity of stations or large villages, where manure is abundant and cultivation more than ordinarily careful, lands in outlying parts are not considered to have regained their vigour till they have lain six or seven years under a wild growth of grass. Hence such lands are not, as a rule, retained by the cultivator, but are relinquished and retaken at pleasure, whereas the patches near his homestead are usually kept in his own hands, to prevent their usurpation by others.

Waste or fallow land is broken up in October. A good deep hoeing is the best treatment, and if the field be *kathani* (timber land) or *murhani* (stump land), that is to say, a forest clearing now for the first time brought under cultivation, this method is the only one possible; but it is not absolutely necessary in the case of a field reclaimed from reed jungle, while fallow land (*khuari*) can usually be brought under the plough at once. Having thus been turned up, more or less thoroughly, with the hoe or the plough, the land is then left till January or February, when the ryot, having gathered his crop of winter rice, is at liberty to recommence operations; at this time also previously-cropped land (*jahali*) is taken in hand, and ploughing, varied by harrowing, goes on with more or less diligence and frequency until the middle of April. The soil has now been thoroughly worked up, the weeds and grass raked out and burnt, and the clods which have escaped the harrow (*moye*) are broken with the mallet (*dalimari*). The duration and number of these operations vary greatly according to the ryot's inducement or inclination towards careful tillage. The popular estimate of twenty ploughings at least is rather ideal than actual; but the ryot understands perfectly well that the value of his crop depends in a great measure upon the depth and thoroughness of tillage preparatory to planting. Then follows the partitioning of the field (*khandod*) into strips of eight to twelve feet in width (*khand*), separated by drains communicating with the ditch (*khdwai*) which surrounds the field on the outside, and which is dug almost waist-deep. The field is now ready for planting as soon as the first showers fall.

The layers from which sugar-cane is propagated in the Assam Valley consist invariably of the topmost joints, and are hence called *ag* (tops); they are sliced off pretty much at random, but are supposed to measure the length of the forearm with the fist closed, and usually comprise three or four joints. During the interval of two or three months between cane-harvest and planting, the layers are kept in a cool and moist spot in the ryot's homestead, placed in a half-upright position in ground which has been turned up by the hoe, covered with rice-straw or plantain leaves to protect them from the sun, and watered occasionally if the weather be dry. When thus treated, they have already begun to throw out shoots (*gazáli*) before transplanting, but when cane-harvest has been prolonged till late in the year, the interval between the cutting and the planting of the layers is very much abridged, and a regular nursery is dispensed with, the bundles of layers being simply kept in a heap under damp straw until they are wanted; this is called *dhuliya* or "dusty" planting. The day chosen for planting must be preceded by sufficient rain, and if drizzling rain lasts throughout the day, so much the better. It is seldom that the date fixed upon is later than the middle of May, though exceptional circumstances may cause it to be postponed till the end of that month, or even the beginning of June. The layers are placed at distances of about two feet from each other, in trenches three feet apart, which run at right angles to the drains (*khand*) dividing the field, and are thus cut up into lengths of eight to twelve feet. Thus calculated the number of layers required to plant one bigha (120 feet x 120) would be 2,400. A carefully prepared estimate from the Nowgong district shows the number as 2,000 to 3,000. It is less in good land than in poor soil where losses from failure to germinate have to be made good. The rate at which layers are sold is liable, like everything else connected with the cultivation of sugarcane in Assam, to great variations from year to year. The present selling price in the Durrung district is 400 to 500 the

rupee, but it was 600 the rupee a few years ago. After the layers have been planted, a little soil, often mixed with cow-dung, is lightly scattered over them, and they are left to themselves for ten days or a fortnight, until they have struck root.

The field is then weeded, and the soil around the young shoots lightly stirred with the spade (*khunti*) or hoe (*kudali*). The latter process is one of great importance, and ought to be repeated at short intervals on sunny days throughout May and part of June, the earth being thoroughly stirred to the depth of six or eight inches, both around the shoots and also between the lines of canes. Manure also may be applied on these occasions, and one or more weedings are usually given. Later on, the earth from the ridges (*dila*) between the trenches (*pati* or *khali*) is heaped about the roots of the canes to strengthen their hold on the soil, and this process is repeated until the relative positions of trench and ridge are reversed, and the canes now stand on ridges with trenches between. This goes on till the middle of August, at intervals varying according to the leisure and industry of the cultivator; but the popular estimate is that the cane should be hoed once a fortnight until Jeth (ending on the 15th of June), and that the weeding and earthing-up should take place subsequently at least once a month. Sunny days are always chosen, and in the earlier stages the prevalence of sunny weather is especially desired, as the earth about the young shoots cannot be stirred while it is wet without injurious effects.

A prolonged break in the rains while the cane is yet young will occasionally compel the ryot to resort to irrigation to save his crop, but such cases are quite exceptional, and seem to be unknown in Upper Assam.

Work in the cane-field is usually at a standstill for about a month from the middle of August. During this time the juice of the cane is sweetening, and the ryot is said to feel a superstitious aversion from entering the field, lest the jackal should follow him. A final weeding and earthing-up are administered towards the end of September or the beginning of October, the canes being at the same time tied together in clusters as they grow, by means of the leaves stripped off the lower part of the stalks, and bamboo props are sometimes added by way of support where the crop is exceptionally tall and valuable. The number of canes springing from a single layer may vary from three to ten, but is usually either four or five, and where more numerous, the canes fall off in size. The person who undertakes the tying-up must be completely clothed, with his hands protected by a covering of cloth, and his feet by sandals of leather or the bark of the betel-plam. It is a laborious process, and is often omitted. Indeed, the whole of the foregoing description must be taken as true only of the more careful style of cultivation practised in the immediate vicinity of villages, while in forest clearings, or patches in the midst of reed jungle, the cane is left pretty much to shift for itself.

Nothing more has to be done now but to fence in the field securely with slips of bamboo intertwined, so as to form a continuous paling about three feet high, and strong enough to cost some trouble in pulling to pieces. Though of no avail against bears or wild elephants, this does save the crop, to some extent, from wild pigs, and from a still more mischievous enemy, the jackal, who, nevertheless, often contrives to find his way in, and eat a large space clear in the centre of the field. The roots of the growing cane, especially if too freely manured, are liable to be attacked by white-ants (*ui pok*), and, in uncovering them to rid them of this pest, injury is sometimes inflicted upon the plant. A rainy October, followed by a dry November and December, causes the top joints to wither and die. Apart from these calamities, however, sugarcane in the Assam Valley does not appear to be liable to any special disease. It does not suffer much from inundation, as the sites selected usually lie beyond the reach of any ordinary flood, while drought is a contingency that hardly comes into the cultivator's reckoning.

A small proportion of the annual cane crop is ratooned, *i.e.*, grown from the roots of the last year's cane, instead of being propagated by layers. The stripped leaves of the previous crop are left lying on the field till April, when they are burnt, and a month latter, when the young shoots begin to appear, a hoeing may be administered and some manure added. Such a crop is called *murha*, or stump cane; it receives little attention from the cultivator, ripens early, and yields only about half as much coarse sugar as an equal area of cane cultivated in the ordinary way. A peculiarity of *teliya* cane, and one of its recommendations to the Assamese ryot, is that it can be ratooned twice.

With the exception of *murha* cane, which is cut early in January, cane harvest does not begin until the winter rice has been reaped and stored. The date is somewhat earlier in Goalpara and Kamrup than in the upper districts, but generally it may be said that the festival of the *Magh Bihu*, or harvest-home of the principal food-crop of the year, corresponding in date more or less exactly to the 15th of January, is celebrated before the cultivator troubles himself with the labours of the cane-press. The operations of cutting, crushing and boiling are carried on simultaniously from this date until the end of March, or even the first few days of April. The canes are cut off close to the root by a single stroke of the Assamese *dao* or bill-hook, the tops are lopped off for layers, and the stalks, stripped of their leaves, are bound in bundles (*mula*) weighing about half-a-maund, and carried to the mill. Where the crop is *pura*, or good, *muji* cane, a small proportion is usually reserved for eating in the raw state, and is worth one or two pie per stalk in the village markets, while in the station bazaars a single stalk is cut up into several pieces, each of which is worth a pice. Thus estimated, the value of a field of sugarcane depends on the number of stalks; and these vary greatly, according to the cultivator's ability to plant the field properly and to protect the growing crop. If we assume an average of one cane to every two square feet, the value of the canes on one rood of land, if sold for eating raw, would be about Rs. 50; but this is quite an imaginary case. The great bulk of the cane grown in the Assam Valley is destined for the mill. Unless of extraordinary length, the canes are not divided before crushing (in Goalpara, however, they are said to be cut up into lengths of 2½ feet), but are passed through entire; the average length of *teliya* cane, stripped, and topped is less than four feet, of *mugi* nearly five feet, and of Bengal *pura* about six feet. The cultivator is well aware of the importance of protecting the juice, while in the cane, from exposure to the air, and therefore he crushes his cane undivided, and only cuts it by parcels as he wants it for the mill, which is always set up in the immediate vicinity of the cane-field.

The sugar mill (called *khorkha* in Goalpara, and *hal* in Upper Assam) is a rude but tolerably effective machine, and a quicker and less dangerous worker than the heavy beam-and-pestle arrangement of Upper India.* It consists of two vertical rollers (*bhim*) placed in juxtaposition, with their lower ends resting in a flat trough (*bhoral*) scooped in a solid and heavy block of wood (*toljoli*) resting on the ground, while their upper ends pass through a rectangular space cut in a horizontal beam above (*borjoli*) supported by uprights (*hol khuta*) let through the lower block into the ground. The rollers are held in their places by vertical clamps (*ghara*), which grip them at the upper and lower ends, and are driven home by wedges (*khul*). The portions of the rollers which project above the upper beam (*borjoli*) are grooved so as to work into each other on the principle of an endless screw. The driving power is a horizontal beam (*kdtari*), applied to the head of the taller or "male" roller (*mata bhim*), upon which the shorter or "female" roller (*maiki bhim*) revolves in the contrary direction. † The "male" roller is usually, if not invariably, that on the right hand as one faces the mill and the direction of progress is from left to right, that is to say, the men at work walk round with the left shoulder inwards. Buffaloes are seldom yoked to an Assamese sugar-mill, and bullocks never. The whole machine is made entirely of wood, without a nail or a piece of iron in its composition, and its value varies according to the kind of wood used. A mill can be built of tamarind-wood for eight rupees, but in *jam* wood (*Eugenia jambolana*) it will cost twelve, and if *nahor* (*Mesua ferria*) is used, as much as fifteen rupees.

All being ready for crushing, the first thing the cultivator does is to bind two of the finest cane-stalks along the beam of the mill, as an offering to Viswakarma, the god of artificers. The canes are then passed through the mill in batches (*ana* or *kani*) of six or eight at a time, the juice falling into the trough, and thence through a hole on to a sloping wooden tray, which transmits it by a lip of plantain leaf to the earthern vessel placed to receive it in a pit dug below. In some places the tray (*rasdhara*) is circular in shape, with a raised wooden edge and a funnel-shaped escapement for the juice, but usually a simple slab of wood, slightly concave, is considered sufficient. The working of the mill is accompanied by a loud and strident noise which is welcomed by the ryot as a sign that the rollers are biting well, and is, moreover, a cheerful and useful accompaniment while the work is carried on by night, as is the practice towards the end of the season, when the heat of the day would be injurious alike to the men and the cane-juice. Each handful of canes is passed through the mill three or four times, until they begin to yield mere foam, when they are thrown aside, and a fresh batch takes their places. *Mugi* and *pura* cane squirt out their juice plentifully on the first compression, and give less afterwards, while the harder and tougher *teliya* passes through almost dry, and only begins to yield juice to the second squeeze. At the third and fourth crushings, the flattened canes are usually twisted into a rope, so as to present a bulkier body for compression. A boy sitting in front of the mill draws them out as they pass through the rollers, and hands them back to the man who sits behind and feeds the mill. Four or five men drive the machine, resting their hands on the beam, and pushing against it with the chest and shoulders. The force required to put the mill in motion was ascertained in one experiment made by Mr. R. T. Greer, sub-divisional officer of Golaghat, to be 5 to 6lbs. without cane, and 40 lbs. with *muji* cane between the rollers, but 60 lbs. with *teliya*. The rate of progress in crushing is about two

* Messrs. Mylne and Thomson claim for their Behia mill the power of crushing thrice as much cane in a given time as the common *kolhu* of Behar and the N.-W. P. Their calculations (which are supported by independent experimental evidence) make the average outturn of the *kolhu* about 100 lbs. per hour. The Assamese mill works at least half as rapidly again.

† The following are the dimensions of a sugar-mill measured in the Majhuli, and may be taken as fairly representative of the machine commonly used in Assam :—

	Length. Ft.	In.	Breadth. Ft.	In.	Thickness or depth Inches.
Toljoli	4	0	1	2	3½
Trough scooped in *toljoli* ...	2	0	0	7½	2½
Borjoli ...	6	6	1	2½	6
Rectangular space in *borjoli*	1	11	0	9	6
Total length of rollers	3	6	...		...
Circumference	2	4½	...		...
Length of grooved part ...	1	1	...		...
Breadth of grooves ...	0	2¼	...		...
Depth of " ...	0	2	...		...
Height of uprights .	2	6	...		...
Circumference	2	4	...		...

The length of each arm of the beam was about nine feet.

The smooth or ungrooved portion of the rollers was thus 2 feet 5 inches in length, but from this must be deducted the spaces covered by the depth of the trough below and the thickness of the *borjoli* above, *i.e.*, 2½ inches and 6 inches: thus, 2 feet 5 inches—8½ inches=1 foot 8½ inches, the length available for crushing.

maunds (165 lbs.) per hour. A good deal of trash and impurity —earth from the imperfectly-cleaned canes, fragments of the stalk, dust carried by wind, &c., enters the earthen pot along with the juice; in fact after a couple of hours' work, mud can be plentifully scraped off the plantain-leaf lip of the tray, but the ryots seldom trouble themselves to clean it. When the pot is full it is changed for another. As the work proceeds the wedges holding the clamps have usually to be driven home from time to time to counteract the tendency of rollers to work asunder.

The juice is thrown into a boat (*ndorá*) scooped out of a log. This stands at the edge of the boiling-house, a few yards removed from the mill, and sometimes contains leaves of the wild fig tree (*dimaru*), which are supposed to be useful in keeping the juice sweet. When some twelve or fifteen gallons have been collected, the boiling begins. The whole apparatus for this purpose is worth about two rupees, and consists of four earthen cauldrons (*thali*), two ladles (*laokhola*) made of half-a-gourd attached to the end of a stick, one of which is usually perforated like a cullender, and a sieve or strainer (*jaki* or *chalani*) of plaited cane with a long handle. The furnace is excavated in the ground, and has four circular openings to receive the cauldrons; the first of these is set some three feet back from the furnace mouth, the second about as far behind the former, while the last two, which are placed side by side at much the same distance in the rear, lie almost beyond the reach of the fire, and are used merely as feeders in which the juice is heated before being transferred to the first or second cauldron for boiling. The cauldrons are invariably made of potter's clay, and in shape are almost exact hemispheres, with a diameter of eighteen to twenty-one inches; the first two, being somewhat larger and of superior quality, usually cost as much as seven or eight annas each, and must be procured from certain potteries where the clay is exceptionally good; Kokilamukh, for instance, enjoys this reputation in Upper Assam. The two feeders can be purchased for about four annas a-piece. Before placing the cauldrons on the fire, their bottoms are smeared with clay tempered with cane juice, while a charm * is repeated to keep them sound and whole: in this way they can be made to last for one or two seasons, and though commonly cracked in all directions, the ryot continues to use them until the bottom falls out, when the fire is withdrawn and the spilt juice carefully scooped up from the floor of the furnace, and strained through a cloth into the new cauldron which is always held in reserve on such occasions, the whole apparatus being at the same time protected against the recurrence of such a malicious mischance by the sprinkling of water over which charms have been muttered against the evil eye.

The fuel consists of reeds (*khagari* or *ekra*), supplemented by the crushed canestalks (*jaban*) as the boiling proceeds. A man or boy feeds the fire, while two men mind the cauldrons, skimming the feeders with the sieve, and lifting the juice in the boilers with the ladle so as to prevent it from boiling over, while they replenish the second cauldron from the feeders, and thence transfer the heated juice to the first cauldron immediately over the fire. This latter operation is usually performed by the man who is entrusted with the duty of determining the exact point at which the juice has been boiled enough: he is always an experienced person, and must be fed well and treated with deference. Lime-water is said to be occasionally administered as the boiling goes on, but this is mentioned in the district of Nowgong alone, and is probably quite an exceptional precaution. In the latter stages of the boiling, care is taken by frequent interchanges of juice to keep the two boiling-cauldrons as nearly as possible at the same temperature. These stages are three in number, and are vulgarly known by the names of *o-phulia*, *babori-phulia*, and *temi-mulia*, implying that the ebullient masses of liquor in the first stage are as large as the fruit of the O tree (*Dillenia indica*) that is, about three inches in diameter; in the second stage they are more frequent, and shrink to the size of the flower of the *babori* (an edible species of the *Compositæ*) in size about equal to the marigold; while in the final stage they present a hollow in the centre, and are thus compared to the little box (*temi*) in which the Assamese peasant carries his stock of lime for consumption with betel-nut. On the appearance of this last sign, the boiling cauldrons are rapidly emptied with the ladle, and replenished again from the feeders without delay, while the fire, which had been slackened at the *o-phulia* stage, is again quickened by feeding it first with two reeds dipped in the fresh molasses, as an offering to the god Agni. The duration of operations depends of course upon the quantity of juice, but the ryot always reckons upon converting his *pal* of cane into sugar in a single day or night that is, with eight to twelve hours' work. Reduced to an average rate, this means that about thirty gallons of juice can be boiled in five or six hours. When the last instalment of juice has been disposed of, the boiling cauldrons are rapidly rinsed with a little warm juice and lifted off the fire.

The liquid stuff ladled out of the cauldrons is received in a wooden vessel (*gholani*) about six feet long, made and shaped in the same manner as the ordinary Assamese dug-out, but with one end cut square; where it is stirred with a Y-shaped instrument consisting of a triangle of bent bamboo fastened to the end of a stick (*hátbari* or *ghotanimari*). As the stirring continues, the liquid loses its dark brown colour, and assumes the hue and consistency of yellow mud. The process lasts half-an-hour. The *gur*, or compost, is then removed from the *gholani* with the hand or a broad slip of bamboo, and put into earthen pots. This concludes the proceedings. The manufacture of refined sugar is an art which has yet to be introduced into the valley of the Brahmaputra.

The word *pal* is used to denote the quantity of cane which is crushed and converted into sugar at a single spell of work, whether by day or by night. The quantity of cane in a *pal* depends a good deal upon whether the cultivator is or is not working against time. It usually consists of twenty bundles, which may be roughly assumed to weigh 10 maunds, or about 800 lbs., but twice as much can be disposed of towards the end of the season, when work begins after the evening meal (9 or 10 P.M.) and continues without intermission through the night and into the forenoon of the following day. The quantity of cane got through on such occasions is commonly reckoned as the produce of one *cottah* (one-fifth of a *bigha*, or 320 square yards). When working by day, the cane is cut and brought to the mill as it is wanted, but for night work it must be cut and stacked before dark. Boiling begins when half the cane has been crushed, and goes on for several hours after all other operations have been concluded. The usual custom is to boil the juice yielded by one *pal* of cane in two instalments as nearly equal as can be guessed, neither of which, however, need fully test the capacity of the boiling apparatus, which is capable of dealing with twenty gallons at once, if the ryot has so much to put into it. The relation between the weight and the volume of the juice has been determined by a series of experiments to be about 11 lbs.* avoirdupois to a gallon: as compared with water, the weight, volume for volume at a temperature of 75° F., was found in one experiment to be as 74 to 67.

It will probably have been perceived from the foregoing description that the manufacture of sugar in the Assam Valley is a purely domestic industry. The ryot has no relations whatever with any manufacturer or money-lender. He grows his cane entirely on his own account, and converts it into sugar by the help of his neighbours, who work for him on the understanding that he will work for them when their turn comes. This system of of mutual assistance relieves the ryot of a good deal of labour, and of almost all expenses; nevertheless, the cultivation of sugar-cane is regarded as a most laborious undertaking, to be attempted only, as the proverb says, by one who has a large family at his back:—

Soy po barah nati,
Tehe koriba kuhiyar kheti;

with six sons and twelve grandsons a man may cultivate sugar-cane.

The area planted by a single family rarely exceeds half a *bigha* (800 square yards), and is often much less; and whenever a large field of cane is met with, it will be found to consist of several such plots belonging to different families, who have cultivated the whole, as they will crush and manufacture its produce, by their united labour applied to each plot in turn.

In reference to an industry conducted on such conditions as these, the term "cost of production" is apt to be *misleading*; and, in fact, on making the calculation at the ordinary rates of hired labour, the expenditure may easily prove to be greater than the value of the article obtained. It is difficult to form an estimate of the cost of cultivation and manufacture that can be relied on with any degree of confidence, but the following statement, compiled from returns furnished by district officers, may be regarded as not very far from the truth:—

Cost of cultivating, crushing, &c., the cane on half a bigha of land (800 square yards).

Cultivation.	Rs.	As.
Hoeing in October	0	8
Ploughing and harrowing (8 times)	3	0
Draining and drilling	0	12
Price of 1,200 cane-tops	2	8
Planting	0	4
Weeding (twice)	0	8
Hoeing and earthing-up (four times)	1	0
Fencing	1	0
Watching	2	0
Revenue of land	0	4
Total ...	11	12
Manufacture.		
Cutting (wages of ten men)	2	8
Crushing (wages)	3	0
,, (hire of mill)	0	8
Boiling (wages)	3	0
,, (fuel)	2	4
,, (one-half value of vessels)	0	12
	12	0
Total ...	23	12

The quantity of sugar manufactured from a given weight of cane by the rude processes known to the Assamese ryot is considerably less than the cultivator obtains in other parts of India, and will not bear comparison at all with the produce of a West Indian factory. A large number of experiments have been made by various officers with a view to ascertain the actual proportions, in weight, of the

* A charm commonly used in the Nowgong district runs in this way:—"Sát patálor máti, Anat kumáre anile káti; Khochi guli dilo chákat, Charu hol Brahmár pákot. Hari Har dák. Phuta, phata, khola, khápori, bali jala, sakar kona, jora lagi thak."

That is to say, "Anat the potter out and brought the earth of the seven worlds, kneaded and wet it, and put it on the wheel; it became a cauldron under Brahma's turning. Call on Hari (Vishnu) and Har (Siva). Breakage and cleavage, chip and potsherd, sand-leak and crevice, be joined and whole."

* The Saidapet experiments, alluded to further on, give an average of 9½lbs. per gallon.

juice and the compost obtained from a given weight of cane. Where made by European or educated native officers, these experiments may generally be regarded as accurate, or as liable to error chiefly on account of the occasional reluctance of the ryots to assist heartily in operations which they secretly regarded as the preliminaries of new taxation. A series of experiments in a rougher fashion and on a larger scale have been conducted by subordinate revenue officers (mauzadars). Here the recorded weights represent the results arrived at by multiplying the average weight of a few bundles of cane, or vessels full of juice or compost, by the number of bundles crushed, and the number of vessels filled. Covering, however, comparatively so large an area, these experiments may be regarded as giving general results that are fairly trustworthy, especially when we consider their remarkable correspondence with the results obtained by superior officers. The two classes of experiments have been tabulated separately, and in detail, at the end of this Note (Appendices A and B). Collating them by districts, we find results as follow :—

Experiments by District Officers.

Districts.	Number of experiments.	Weight of cane crushed.	Weight of juice.	Weight of *gur*.	Per 100 lbs. cane. lbs. juice.	lbs. *gur*.
		lbs.	lbs.	lbs.		
General results ...	5	10,613	4,959	707	46·7	6·6
Lakhimpur ...	7	7,671	3,268	569	42·6	7·4
Sibsagar ...	6	13,567	5,722	1,115	42·2	8·2
Darrang ...	11	7,218	2,781	367	38·7	5·1
Kamrup ...	3	2,887	1,205	223	42·5	7·8
Goalpara ...	32	41,900	17,935	2,081	42·8	7·1

Experiments by Mauzadars.

Kamrup ...	3	3,624	1,420	232	39·2	6·4
Darrang ...	9	18,201	8,137	1,442	44·7	7·9
Nowgong ...	2	2,592	1,326	234	51	8·8
Sibsagar ...	15	53,034	26,483	3,731	50	7
Lukhimpur ...	1	1,028	411	82	40	8
General results ...	30	78,479	37,777	5,721	48·1	7·3

We may reasonably conclude from these figures that the ordinary cane-crop of the Assam Valley cannot be counted on to yield more than 43 per cent of its weight in juice, and 7 per cent of its weight in coarse sugar. For an average struck upon all kinds of cane cultivated under all circumstances, even these figures are probably too high. Much better results may be obtained where special care has been bestowed upon the crop; the list of experiments by district officers at the end of the note shows that in several instances 50 and even 60 per cent of juice, and 10 to 13 per cent of *gur* has been got from a given weight of cane; but these are exceptional cases, and do not represent the sugar-yielding capabilities of the common cane of the country.

The weight of cane grown on a given area of land varies much more than the proportion between a given weight of cane and the weight of juice or *gur* obtainable from it. The species of the cane makes a considerable difference; *pura*, for instance, is a much heavier crop than *teli*. Speaking generally, a well-cultivated field will yield to the mill about one pound of cane to every square foot, while a field carelessly cultivated, or insufficiently planted, or exposed to the depredations of animals, will hardly give one pound to every three square feet of its area: thus the limits vary from six to nineteen tons per acre; while an arithmetical mean, which is probably somewhat in excess of the actual average, may be deduced from the following statement, compiled out of the details given in the appendices :—

Experiments by District Officers (24 in number).

Districts.	Area cut (square feet.)	Weight of cane. lbs.	lbs. per acre
Golpara	10,890	8,722	34,888
Kamrup	14,536	6,067	18,180
Darrang	18,577	13,567	31,814
Sibsagar	12,876	7,218	22,419
Lakhimpur... ...	3,180	1,769	22,695
General results ...	60,059	37,343	27,083

Experiments by Mauzadars (30 in number).

Districts.	Area cut (square feet)	Weight of cane. lbs.	lbs. per area.
Kamrup ...	10,332	4,396	18,417
Darrang ...	29,916	18,201	26,500
Nowgong ...	4,284	2,592	26,356
Sibsagar ...	79,920	53,703	29,270
Lakhimpur ...	1,440	1,028	31,097
General results ...	125,892	79,920	27,429

These figures, though without any pretension to absolute accuracy, may be accepted as representing the results of measurements and weighments made with as much care as would be taken in a wholesale commercial transaction. In using them for the purpose of educing general averages, it is necessary to remember that the most promising plots stand the best chance of being selected for experiment, that fields in the jungle must be rated far below those in the vicinity of villages, and that while the great majority of the experiments were made with *mugi* cane, it is the less productive *teliya* which the district reports would lead us to regard as the predominant species. Bearing these facts in mind, we may perhaps conclude that the average Assamese cane-field bears 10 to 11 tons per acre;* and such a weight of cane will yield about 1,400 lbs. of *gur*. Compared with other parts of India, these results are poor. In the North-Western Provinces the average yield per acre, irrigated and unirrigated, taking all the districts together, is estimated at 2,300 lbs. of *gur*,† and the *gur* of Upper India is better dried and more durable than that of Assam. Part of this superiority in yield of sugar is due to the greater quantity of juice expressed, for cane in the North-Western Provinces gives one-half of its weight in juice. If we look to Madras, it appears that the common country mill of the Bellary district, built on much the same principle as the Assam mill, but costing Rs. 72 for the rollers alone, can extract 66 lbs. of juice out of 100 lbs. of cane, and this will yield 12 lbs. of sugar,‡ or double as much as could be got from the same weight of cane in the Assam Valley. The fault lies less in the Assamese mill than in the cane; for the Bihia mill extracts 67 per cent of juice from Madras cane, while the best experiment with it in the Assam valley has not given more than 56 per cent. In Behar the average produce of *gur* per acre is estimated at the very high figure of 40 maunds, or 3,300 lbs.; in lower Bengal (the Rajshahye and Burdwan districts) at 2,500 to 1,800 lbs.; § lastly, in the Beelin cane tract in British Burmah, the outturn of an acre well cultivated is estimated at 3,500lbs. of *gur*.‖

We are now able to complete our calculation of the ryot's profits on sugar-cane. The cost of growing and converting into coarse sugar the cane on half a bigha of land (800 square yards) was estimated at Rs. 23-12. The produce will be some 4,000 lbs. of cane, which may be expected to yield about 240 lbs. of the compost called *gur*. The ryot will probably keep the greater part of this for domestic consumption; but on the supposition that he disposes of the whole of it by retail sale in the petty markets, it will fetch about 2½ annas per seer, or some 19 rupees altogether, thus failing to cover the cost of cultivation and manufacture.¶ The mode of sale is in small earthen pots containing about 2 lbs. each, and worth from two to three annas, or even as much as six annas in a dear year; or else in large earthen vessels (*kalsi* or *kalah*) holding some 20 lbs., and priced according to their weight; or he may sell by the maund, at the rate of four to five rupees. The conditions of production, however, are such that nothing like a fixed proportion exists between supply and demand. The market gets only the overplus from domestic needs, and the price rises and falls from year to year according as this happens to be little or much. In 1879-80, in the Nowgong district, a *tekli*, or small earthen jar, containing about two seers of *gur*, sold for 8 to 10 annas, or at the rate of about 10 rupees per maund; the present year, on the other hand, is one of abundance, and *gur* was selling in April at Rs. 2½ per maund in Kamrup and Darrang, while the price throughout last year in the vicinity of Dibrugarh ranged from Rs. 8 to Rs. 9 per maund. Assamese *gur* is never sold in the large balls or masses of hard compost which are so familiar in the bazaars of Upper India. In the winter it barely attains a solid consistency, and shows a slight tendency to granular crystallisation, but as the weather grows hotter it liquifies, and if not speedily consumed often becomes sour and useless.

* NOTE—It is hardly necessary to repeat that a single field of one acre probably does not exist in the valley of the Brahmaputra.

Some additional statistics may here be quoted. Five experiments made last year in Sibsagar, on an area of 1·13 acres altogether, gave an average outturn of 1,517 lbs. of *gur* per acre. The average assumed in the text is perhaps corroborated in some degree by the rough estimates of the ryot. In the southern part of the Kamrup district 20 to 25 *kalsis* are estimated as a fair outturn for a *bigha* of land. The *kalsis* contains about 20 lbs. of *gur*, so that the outturn o *gur* per acre would be 1,200 to 1,500 lbs. Another estimate is 6 *kalsis* per *cottah*, or 1.800 lbs. per acre, as the produce of a good field. In some villages where cane-crushing was going on, I measured up the area of cane cut for a single *pál*, and weighed the *gur* obtained, with results as follows :—

Square feet.	lbs. *gur*.	lbs. per acre.
3,875	62	796
3,038	52	776
3,177	56	759
7,200	131	807
972	47	2,100
1,746	74	1,850

These very poor results obtained by ryots when working by themselves show that the estimate in the text is not too low.

† *Field and garden crops of the North Western-Provinces and Oudh*, Roorkee, 1882.

‡ Saidapet Experimental Farm Report for 1881-82.

§ These figures are taken from papers published by Messrs. Thomson and Mylne.

‖ Quoted from a Note by Mr. D. M. Smeaton, Director of Agriculture, dated the 9th October 1882.—These figures, however, seem small in comparison with some statistics of cane cultivation in Australia. I find it stated in the *Brisbane Courier* that the outturn per acre on one Queensland plantation is estimated at 37 to 40 tons of cane, and one ton of cane gives 150 gallons (about 1,500 lbs.) of juice.

¶ In confirmation of this estimate, which I believe rather underrates the loss which would follow cultivation *by hired labour*, I may mention that a European engaged in farming near Bishwanath in the Durrung district showed me a crop of the *pura* cane which had already cost him so much that he doubted whether it would be worth his while to cut and crush it. It will be observed, moreover, that one of the ryots quoted in the note above got only 131 lbs. of *gur* from his half *bigha* of cane.

The area under cane in the valley of the Brahmaputra in 1882-83 is stated to be as follows:—

	Acres.
Goalpara	425
Kamrup	4,381
Durrung	2,219
Nowgong	4,283
Sibsagar	3,630
Lakhimpur	718
	15,656

These figures must be regarded as only an approximation to facts. There is reason to believe that for Goalpara (where we have to depend on the zemindars for our statistics), they fall short of the truth, while in other districts some jungle cultivation may have escaped record. Again, the area is subject everywhere to great fluctuations from year to year. A dear season stimulates production while a cheap one discourages it; and thus cultivation is liable to contract and expand in alternate periods. Thus, in Nowgong the high price of *gur* in 1879-80 was followed next year by an increase of nearly 70 per cent in cultivation, while the low price of 1881-82 induced a decrease of 30 per cent in the year following. Taking the total area under sugarcane in the Assam valley to be 16,000 acres in round numbers, the average outturn as 1,400 lbs. of *gur* per acre, and the price as Rs. 4-8 per maund of 82 2/7 lbs., the whole weight of sugar produced in a year would be 10,000 tons, valued at Rs. 12,25,000.

The whole of this is locally consumed, no portion being exported either to Bengal or to the frontier tribes. It is not, in fact, sufficient by itself for the wants of the country. The import from Bengal during the last three years has been as follows:—

	1880-81. Maunds.	1881-82. Maunds.	1882-83. Maunds.
Refined ...	13,217	11,564	10,974
Unrefined ...	39,473	28,849	34,980
Total ...	52,690	40,413	45,954

Refined sugar is consumed almost exclusively by Europeans, well-to-do Bengalees, and Marwari traders, or is used at festivals in the great *Shattras*. If unrefined sugar alone be taken into consideration, we find that the average annual import during the last three years has been 2,833,426 lbs., and, the local production of sugar being 10,000 tons, the sum of these two quantities, when divided by the population of the Assam valley (2,225,271), gives a yearly consumption of 11 mds. per head. This calculation tends to show that the average outturn of sugar per acre has not been under-estimated. In the Punjab and the North-Western Provinces the estimate of the consumption of sugar made for the Famine Commission in 1879 was 30 lbs. per head of the population, and when we remember how largely the Brahmaputra valley is peopled by races (Mech, Kachari, Mikir, Lalung, &c.) to whom the use of sugar is unfamiliar, besides the utter absence of large cities with their wealthy classes, it is difficult to believe that the average consumption in this part of Assam can exceed one-third of the figure estimated in Upper India.

The first condition necessary to any improvement of the cultivation of sugarcane in the Brahmaputra valley is a wider market. There is no present demand beyond domestic wants, if we except two small ventures in the Sibsagar and Lakhimpur districts, which prove, in their limited way, that the production of sugarcane can be stimulated without difficulty. These are two distilleries established by enterprising Europeans near Golaghat and Dibrugurh, where the *gur* of the country is converted into rum for consumption by tea-garden coolies. Situated in the centre of thickly-peopled tracts, these factories have stimulated the production of sugarcane considerably within the limited area on which they draw for their supplies. The Dibrugarh factory uses Bengal *gur* largely, while that of Golaghat depends entirely on local production. When the latter was first started in 1879, the proprietor found some difficulty in procuring *gur* at all, but now he draws upon the cane crops within a radius of five miles, and cultivation in the neighbourhood has increased about 28 per cent. But neither the one concern nor the other is on a sufficiently large scale to affect seriously the general cultivation of cane, or to test the remunerativeness of such an enterprise if conducted with a larger capital.

These enterprises are by no means the first of their kind. A similar experiment was tried in the preceding generation by a Mr. Herriot in Gauhati, and a Mr. Wood at Dobapara, in the Goalpara district, and ruins of old rum or sugar factories existed, or still exist, near Jorhat and at Numaligurh (now a tea-garden) in the district of Nowgong. The end of all these speculations, whether from the dearness of labour in the Assam valley, or as has been alleged in Gauhati, from mismanagement of the concern, was a failure so complete that no record of them can now be obtained, and we do not know how far they depended on the produce of the country, or sought to supplement it by importations of *gur* from Bengal. It is probable that they all started in the hope of finding a new field for sugarcane in Assam, and the efforts made by Mr. Herriot to introduce a better kind of cane were so far successful that the best cane of the present day in Kamrup and Durrung traces its origin to them. The native cane being so small, hard, and dry, one obvious means of improvement is the introduction of a better stock from Bengal or elsewhere; and experience has proved that the soil and climate are sufficiently congenial; but the cultivator will take no steps in this direction by himself, and in the large areas of thinly-settled country the native canes will always be preferred, as needing less protection from wild animals, and entailing a smaller loss in their destruction where protection proves insufficient. The ravages of wild beasts are no trifling obstacle to the development of cane cultivation in this part of India.

It has already been stated that refined sugar is nowhere manufactured in the Assam valley. Even in the manufacture of *gur*, however, no one who has witnessed the rude processes employed by the ryot can doubt that very great room remains for improvement. Reasons have already been given for believing that the country mill works more rapidly than the *kolhu* of Upper India, and perhaps it may, therefore be somewhat less effective as a crusher; but, on the whole, it seems probable that the smaller proportion of juice obtained in these parts (42 per cent, against 50) must be attributed mainly to the inferiority of the cane. Recent experiments, however, with Mr. Cantwell's modified form of the Bihia mill* show that Assamese cane can be made to yield as much as 56 per cent of its weight in juice. It is in the boiling that the greatest loss occurs, 100 lbs. of cane yielding only 5 or 6 lbs. of *gur*, against 15 to 18 lbs. in the North-Western Provinces and 12lbs. in Madras. This difference, while probably arising in part from the poorer quality of the juice, is also due in great measure to carelessness in manufacture. In the vast majority of cases, no preventives of acidification are used in any stage of the process, and the boiling is often conducted by guess work.

The valley of the Brahmaputra is a country of peasant proprietors, in comfortable circumstances indeed, but without intelligence, enterprise, or capital, and any improvement, whether by the introduction of better kinds of cane or of a better mill, or by greater care in the manufacture of sugar, must be looked for from without.

Land fitted for sugarcane can be leased from Government at the yearly rent of 8 annas a *bigha*, or Rs.1-11 per acre (including assessment to local rate), and there is the widest possible choice of sites. It is, however, more than doubtful whether cane-growing by hired labour could be made to pay: on the other hand, the central factory system, which has proved so successful in the West Indies and in Australia, can scarcely be introduced in the present defective state of communications and means of transport in the Assam valley. Where the commonest vehicle for loads is a bamboo carried on men's shoulders, there is obviously some difficulty in transporting the produce of an acre of sugarcane to a mill situated at a greater distance than a few yards.

B.—The Surma Valley.

(*Sylhet and Cachar.*)

Sugarcane is cultivated in the Surma Valley in much the same fashion as in the valley of the Brahmaputra, but the local names of the common kinds of cane are different. In Sylhet, besides the so-called *Bombay* cane we find the *dhali*, or white, and the *surang*, or red, cane; in Cachar the *Bombay* cane is highly esteemed as the largest and juiciest and the best sugar-producer, and is sometimes grown as a garden product and eaten in the raw state, while the *langli* cane appears to correspond to the *mugi*, and the *shamsheri* or *kumrangi* to the *teli* of the Assam valley. Both districts possess also a small hard species, called *khagari*, or reed cane, which may be compared to the *malaha* of the Assam valley, and in Cachar this and the other inferior sorts are said to be most in favour, as requiring less care and being less liable to disease or the attacks of grubs and wild animals. The site chosen is high land in the vicinity of a village if possible (*chara*), or, failing room there, on the bank of a river. Oil-cake (*parkai*) is used as manure a couple of months after planting, if the cultivator happens to have had a mustard crop of his own, and in Sylhet it is even bought for the purpose.

The processes of manufacture are practically the same as those which have been described at such length as prevailing in the valley of the Brahmaputra. The mill, here called *kamrangi* or *ghani*, is sometimes driven by bullocks, and the Cachar ryot is said to cut his cane-stalks into pieces twenty inches long before crushing; in this district also iron cauldrons (*karhai*) are occasionally employed. In some parts of Sylhet the cultivator boils the juice imperfectly, and sells the liquid product (or so much of it as he does not want) to men of the *Lowait* caste, who boil it down into solid compost (*bandha gur*). The liquid or *lali gur* is worth about Rs. 2, and the hardened compost some Rs. 4 to Rs. 5 per maund. Refined sugar is never made.

The cultivator of sugarcane in the Surma valley is independent of the money-lender, unless he is beginning for the first time, and has not ready money to buy cane-cuttings. In that case he takes an advance, repayable with interest when the crop is harvested. The rate at which cane-tops sell in Cachar is stated as 200 the rupee, but this seems exceptionally high. In Sylhet, again, the ryot is said to borrow money to buy oilcake (*kholi*) for manure.

There is no system of village records in the Surma valley, and the estimates of the area under sugarcane must therefore be regarded as conjectural. The method employed in Cachar was to require returns through the officers in charge of police-stations, from the village policemen of their circles; these latter furnished lists of the sugarcane fields within their beat, giving the length and breadth of each in "reeds" of 24 feet, and the station officers worked out the circle areas and sent them into head-quarters. This gave a total of 786 acres, but it was believed that their apprehensions of new taxation had induced the people to understate the facts, and on a comparison with the results obtained by actually measuring up the area under cane in three mauzas of each tahsil, the total extent of sugarcane cultivation in the district has been estimated at 900 acres. For Sylhet no estimate that can be relied on with any degree of confidence is forthcoming, but the area under sugarcane in this district has for some years past been shown in the annual administration reports as 8,000 acres.

The subjoined synopsis of the Surma Valley experiments shows the area cut and the weight of *gur* obtained; in Cachar, the

* See the *Assam Gazette* of the 2nd June 1883.

weights of the cane and of the juice have also been recorded. This meagre tale of experiments has been eked out by a; those which were made in Sylhet in the cane harvest of 1

District.		Number of experiments.	Area cut. Square feet.	*Gur* obtained. lbs.	*Gur* per acre. lbs.	
Sylhet	...	5	4,084	290	3,093	
,,	...	2	708	70	4,307	
,,	...	1	10,890	288	1,152	* 1881.
,,	...	2	20,146	1,083	2,339	
,,	...	2	7,078	293	1,804	
Cachar	...	1	2,304	43	813	
,,	...	*1	1,260	46	1,590	

The Cachar statistics of weight of cane and juice stand as follows:—

	Area cut. Sq. ft.	lbs. cane.	lbs. juice.	lbs. cane per acre.	lbs. juice per 100 lbs. cane.
1st experiment ...	2,304	452	216	8,555	47·8
2nd ,, ...	1,260	555	259	19,173	46·6

The Sylhet product is evidently *lâli gur*. To reduce it to the semi-solid *gur* common in the Assam valley, about 12 per cent of its weight should be deducted.

The statistics of import and consumption for the Surma valley may be considered apart from those of the Brahmaputra valley, because the traffic in sugar between these two parts of the province of Assam is *nil*. The returns of river-borne trade collected at Bhairab Bazaar on the Megna show the following figures for sugar in the last three years:—

	Imports.		Exports.
	Refined sugar. mds.	Coarse sugar. mds.	Coarse sugar. mds.
1880-81	14,140	60,263	*nil.*
1881-82	12,956	79,354	1,420
1882-83	21,306	103,909	1,375

Besides the small export towards Bengal, about 1,200 maunds of coarse sugar are yearly drawn from the Surma valley by the Khasi and Jaintia hills.

The average consumption of sugar per head of population is estimated at 4 chitacks a month in Cachar, *i.e.*, 6lbs. a year, but this seems low. Certainly Sylhet, with its large Mahomedan population, should not consume less *gur* per head than the Assam Valley. Assuming, therefore, an average of 10lbs., and dealing with coarse sugar only, we can make the following calculation:—

	lbs.
Population of Sylhet and Cachar ...	2,282,867
One year's consumption of sugar ...	22,828,670
Deduct net imports of 1882-83 ...	8,338,341
Remains to be provided by the produce of (say) 9,000 acres	14,490,329
Thus the average produce per acre ought to be	1,600

Whether sugarcane is really more productive in the Surma Valley than in Assam proper, we have no means of judging with certainty. There is, however, nothing improbable in the supposition, considering the density of the population in parts of Sylhet, and the known fact that an acre of land yields more rice in Sylhet or Cachar than in the Assam valley districts. The custom of borrowing money to buy manure in Sylhet, if it prevails extensively, seems also to point to a more careful style of cultivation.

The value of the sugar produced in 1882-83, as thus estimated in quantity, and taking the price at Rs. 4-8 the maund, would appear to be about eight lakhs of rupees: at the same rate, the sugarcane crop is worth 80 rupees the acre, a sufficiently probable valuation, though evolved from data extensively coloured by conjecture.

E. STACK,
Director of Agriculture.

* One series of two experiments, which gave a maximum outturn of 6,000lbs., of *gur* per acre, and an average of 4,828 lbs., has not been recorded.

SELECTIONS.

AGRICULTURAL EDUCATION IN CEYLON.

WE append the new scheme for Agricultural Instruction in Ceylon drawn up by Mr. Green, Director of Public Instruction. It has now been sanctioned by the Executive Council, and it is well that our readers should know exactly what is officially sanctioned. Many people already say that Part II of Mr. Green's scheme will be a failure, because though the Native Agricultural Society may agitate, yet no actual support will be given to anything practical, and no young men will come to the school of agriculture for fear of being "made coolies of." We trust this unkind way of foretelling failure may be belied, and it is well that Mr. Green has endeavoured to dispel this fear by providing for a really high English education, as well as a mere agricultural training in the school of agriculture, and if he (the Director) can further induce the Government to provide that (after a few years' warning) nobody should be made Mudaliyar or Muhandram of a Korale, unless he has some knowledge of agriculture, then we feel sure the school will soon fill. If it fills and succeeds, the Director may make it part and parcel of the Royal College, though separate in buildings—like "the modern side" now so common in great schools at home. Any way, if it fails the Director has clearly done his best. And let the leaders of the Ceylonese remember that Government can then say: "You cried out for Agricultural Education—we have offered it to you. If you don't take it, why, don't complain of Government doing nothing more." We are, however, not without hope of success,—and for the following among other reasons:—We learn that the result of Mr. Green's speech at Kandy at Trinity College has been that 15 applicants have come forward for 30 ploughs, and he is getting some of the light Swedish ploughs over from Saidapet, where Dr. Robertson has after a long trial reduced them to a minimum of weight and cost.

Scheme for Agricultural Education in Ceylon.

Part I.—Preliminary Education in all Government Schools.

1. Preliminary and Theoretical Agricultural Education shall be provided in all Government Vernacular and Anglo-Vernacular Boys' Schools, by means of such text-book or text-books as shall from time to time be approved by the Department of Public Instruction.

The subject of Agriculture shall be compulsory for boys in the Standards VII, VIII, VI and V, but any boy in any other Standard may take up Agriculture if he pleases.

2. Teachers under training in the Normal School shall, from the date upon which these rules come into effect, be required to pass in the text-book or text-books mentioned in clause I; and such text-book or text-books shall form one of the subjects for the annual December examination for certificates now required for Government school-masters; and no Government teacher shall hereafter receive the certificate of the Department of Public Instruction, unless he shall have been awarded at the above-mentioned certificate examination not less than 25 per cent of marks in Agriculture.

Part II.—The Colombo School of Agriculture.

3. A special school to be called "The Colombo School of Agriculture" shall be opened in January 1884.

4. For the present, the Colombo School of Agriculture will be held at Colombo in that portion of the buildings of the Normal School heretofore assigned to Anglo-Vernacular Student Teachers.

5. The object of the Colombo School of Agriculture will be to provide a superior and suitable education for the sons of native gentlemen, and more especially land-owners. With this view the teaching will embrace (1) The higher branches of English, (2) Mathematics; (3) Agriculture; (4) Botany; (5) Chemistry.

The study of Agriculture will be divided into—

(1) *Theoretical Agriculture*, which will be taught by means of lectures, text-books, and examination papers.

(2) *Practical Agriculture*, which will be taught and illustrated by practical lessons and experiments on a practising farm to be connected with the School.

6. The School of Agriculture shall be under the management of the Department of Public Instruction. It will be immediately presided over by the Principal, who shall be an English gentleman duly qualified, with the assistance of under-masters, native or otherwise, as occasion may require.

7. As a general rule no boy under sixteen years of age nor over nineteen will be admitted to the School of Agriculture; but exceptional cases may be specially considered by the Director of Public Instruction. Boys will have to be tested by a preliminary examination before they are allowed to enter the School.

8. Thirty boys can be taken as boarders under the immediate care and supervision of the Principal. Out of these thirty students, fifteen may be boarded and educated at a reduced charge of R5 per mensem upon the recommendation of the Government Agent of the Province in which the student resides. For the remaining boarders a monthly fee of R10, which will include all charges of board and education, will be charged. A limited number of day-scholars will also be admitted to the School of Agriculture; and for these a fee of R2 per mensem will be charged.

6. The terms and holidays of the School of Agriculture shall be the same as those of the Royal College.

10. The course of instruction at the School of Agriculture shall extend over three years, and shall be divided into three stages.

Stage I. (First Year.)

English.—As in standard VIII of Government English schools.

Mathematics.—Arithmetic to the end of decimals, and Book-keeping. Algebra to the end of Simple Equations, Euclid I to III.

Theoretical Agriculture.—Text-books, lectures, &c.,

Botany.—History, Physiology, and Classification.

Chemistry.—Chemical Physics and Inorganic Chemistry.

Stage II. (Second Year.)

English.—As for Cambridge Local (Junior).

Mathematics.—All the rules of Arithmetic, Book-keeping, Algebra, Euclid books I to VI.

Agriculture.—Text-books and lectures, and practical teaching, experiments in drainage, manures, ploughing, &c., on the practising farm.

Botany.—Agricultural and Economic.

Chemistry.—Inorgamic and Organic.

Stage III. (Third Year.)

English.—As for Cambridge Local (Senior.)

Mathematics.—Algebra, Euclid, Mechanics, and Trigonometry.

Agriculture.—Practical teaching on the practising farm, cultivation of a plot of ground by each student as provided in clause II.—Lectures,

Botany.—Arboricultural and Horticultural.
Chemistry.—Organic.

11. In the third stage, a particular plot of ground on the practising farm will be assigned to each student, the tillage, manuring, &c., of which will be conducted entirely under the students' supervision and directions. No student will be obliged to work himself, unless he wishes to do so, but he will be allowed to supervise and direct a *goyya* working under his orders. Prizes will be given to those students who best conduct the working of their plots.

12. In addition to the above prizes, there will also be awarded prizes after the examinations at the end of each term to the student who obtains the highest marks in each of the subjects taught in the school, namely—(1) English; (2) Mathematics; (3) Agriculture; (4) Botany; (5) Chemistry.

But no prize will be given for English, Mathematics, Botany, or Chemistry, unless the student obtaining the highest marks in these subjects shall have also obtained not less than 25 per cent of marks in Agriculture.—H. W. GREEN, D.P.I.—*Ceylon Observer.*

A VETERINARY COLLEGE.

A PROJECT has been set on foot in Bombay to establish a Veterinary College. The initiative is to be taken by the local Government. At a meeting of the Bombay Town Council held on the 19th ultimo, the subject came on for discussion, as the Government wished to know to what extent municipal funds would be available to forward the scheme. It was decided that if the Director of Public Instruction included in the municipal budget estimates for education a sum of money towards the cost of providing instruction in the new Veterinary College, the Town Council would be prepared to consider the propriety of recommending the Corporation to sanction a grant on that account. The Bombay Veterinary College will supply a long-felt want in the Western presidency, and probably, the scheme will be worked for the purpose of supplying the districts with trained veterinarians and the military branch of the service with qualified men for mounted corps. While the sister presidency is arranging to carry out a useful public project, very little if anything is being done in the Madras Presidency to train young men for veterinary work. About two or three months ago, we alluded to the great want felt in all large towns in the mofussil for trained veterinarians, not only to treat farm stock which are frequently subject to disease, but the better classes of inhabitants who own horses are unable to secure the services of men capable of treating diseases common to horse-flesh and farm stock. Their labors will be better appreciated than that of self-constituted veterinarians.

In the School of Agriculture, in connection with the Sydapet farm, the pupils attending the veterinary class have the benefit of the lectures delivered by Veterinary-Surgeon Mills; who is also Inspector of Cattle-Diseases in this presidency. Some time ago, the Superintendent of Government Farms announced the opening of a veterinary class at Sydapet, and it was then intended to train men for veterinary work in connection with the treatment of cattle-disease, which is prevalent in the districts at all seasons of the year and to the effects of which thousands of farm stock succumb. What has been effected in this direction we have yet to learn from official reports. It was intended to post veterinarians to the different districts after they had passed the necessary examinations at the School of Agriculture, to supply them with medicines to distribute among the owners of cattle, to impress upon them the necessity of adopting measures immediately on the appearance of disease, to segregate cattle, to avoid the rude and dangerous practice of large flocks of sheep and goats suffering from disease being allowed to stand for hours together in running streams near villages which are often the only sources of water supply of the people, and of otherwise doing away with old and effete systems for treating cattle disease. If trained veterinarians have been sent to the districts and if they have been able to achieve anything, it is time that that little was made public. There are districts in the presidency where cattle disease in some form always exists. Permanent veterinarians are required—or if it is not possible to post one qualified man to a district, there may be one for every two or three districts. The existing practice is that when cattle disease, in the form of rinderpest or foot-and-mouth disease, makes its appearance, to order the Inspector of Cattle-Diseases, or a qualified officer from the Sydapet farm to the infected locality: but by the time the veterinary officer arrives at the scene the disease spreads, or it has done its work of destruction among cattle and the labors of the inspecting officer are directed to the issuing of instructions to owners of farm stock to avoid further outbreaks. If district veterinarians have been appointed to the mofussil and are carrying out useful work, it will be of public interest to make the fact widely known.

Apart from the duties that devolve upon district veterinarians to look after farm stock, the demand for qualified men to treat horses and cattle belonging to private people is great. In all large towns the number of European residents is steadily on the increase, and with the opening of railway stations, factories, and other industries, the wants of the residents in this respect are gradually making themselves felt. Before the introduction of the Towns' Improvement Act in the districts, there were hardly any taxable draught cattle in large towns. With the increase in the number of horses the want of qualified veterinarians is felt, and there is no question that owners of horses have been compelled to send valuable animals to Madras for treatment. There is a promising field for well trained veterinarians in mofussil towns. "Hindu horse doctors," as they are called, are now almost unnoticed, their occupation is going if it has not already gone. It is not an unusual circumstance for a mofussil resident to complain that he has lost a valuable horse or pony or a good specimen of draught cattle owing to the defective treatment received at the hands of itinerant veterinarians who, like village physicians and quacks, ought to be gradually improved off the face of mofussil towns. If a public association or society like the one which celebrated the fourth anniversary of its establishment the other day were to induce a few Eurasian lads to acquire a knowledge of veterinary science, some good work might be accomplished, and a new field of employment opened out to persevering and steady young men.—*Madras Standard.*

INDIA AS A WHEAT COMPETITOR.

WE have prided ourselves upon the supremacy of our agricultural interests in this country and in the conviction that Europe is dependent upon us to supply whatever deficiency she may experience in her food products, which has usually been fully equal to our surplus. But it is useless to shut our eyes to the fact that India is rapidly coming to the front as a wheat-producing country, and is already sending to the British markets a considerable amount of wheat, with every indication that in the by-no-means distant future the quantity grown and exported can be almost indefinitely increased. Hitherto the chief obstacle to wheat production and export from India has been the lack of transportation facilities from the interior to shipping ports. But this is being remedied by the building of railroad lines, opening up the interior provinces, not as in this country by private capitalists as a business enterprise, but by the Government as a necessary Government measure. The Government of Great Britain is in a measure paternal. That of India is still more so, and of necessity since the great mass of its population is always so close to the border of pauperism and starvation that the care of the Government must be constantly exercised in its favor. Hence the building of railroad lines to open up agricultural districts to the markets of the world is regarded as entirely legitimate, and within the proper province of the Government. Under this system interior provinces remote from shipping points are being opened solely with the view of furnishing an outlet for wheat which can be produced for the European markets. The first exports of Indian wheat were made only fifteen years ago. In 1875 the export only amounted to 1,500,000 bushels. In 1878 it was 4,000,000, and in 1881-82 it was 37,000,000, or nearly half the amount which Great Britain requires to supplement her own crops. The cheapness at which wheat can be produced in India, with its cheap labor, is an important element in the problem. According to the British *Trade Journal*, the cost of production does not exceed from sixteen to twenty cents per bushel, or less than half the cost of production, under the most favourable conditions, in this country. The quality of the wheat grown is also another important element. It is claimed to have a thinner bran and to make a larger per cent of flour than either the English or American wheats, some varieties giving from 77·5 to 80·5 per cent of flour, against 65·2 from English and 72·2 from American wheat. The ocean freights from Indian to Europe are greater than from our Atlantic ports, but not greater than from our Pacific ports which furnish quite a percentage of our export wheat. The staple food of the great mass of the population of India is rice, not over 10 per cent being regarded as consumers of wheat. This being the case there would, unless the habits of the people greatly change, be a much larger per cent of any given crop for export than in this country, where wheat furnishes a staple article of food for almost our entire population.

Is there anything to cause alarm to our farmers in this outlook for our surplus wheat in the future? Not as it seems to us. Our population is increasing at an unprecedented rate, requiring each year larger amounts of wheat for home consumption. Excepting as a crop on newly broken lands, we do not regard wheat-growing as by any means the best use to which the farmer can devote his lands. Constant cropping with wheat causes a rapid deterioration of the soil as has been demonstrated in every wheat-growing country. As the country grows older, wheat production instead of occupying the front rank falls to the rear, other crops, stock or dairy, taking its place to the greater profit of the farmer. In the production of meats and their products we, with our rich grazing and meadow lands and our mammoth corn fields, can compete with the world. The same is true of dairy products. Even should India with its ten-cents-a-day rice-fed labor finally capture the wheat markets of Europe, the American farmer will still find profitable use for his land in other directions. The development of sorghum-sugar production to the supply of our domestic consumption would alone save to the country as large or nearly as large an amount of money as we now receive from our exports of wheat to Europe.—*Farmers Review.*

PANDANUS; OR, SCREW-PINE BREAD.

THE *Pandaneæ*, or screw pines, are a most interesting group of endogenous plants, somewhat palm-like in their habit. They are either shrubs or trees, with numerous adventitious roots, which often, indeed wholly support the tree after the main or true root has rotted away. They have long, imbricated, amplexicaul leaves, the margins and backs of which are usually spiny. The fruits are either fibrous drupes, collected in parcels, or berries; in the drupes the seeds are solitary, in the berries numerous.

The best known examples of this order are *Carbedovica Pandanus*, and *Nipa*; although, by some authors, *Carludovica* and *Nipa*

are taken as typical genera of natural orders. (See Dr. Hooker's edition of Le Maout and Decaisne's Botany.)

The genus *Carludovica* is confined to South America, and the so-called Panama hats are made from the leaves of the *C. palmata*.

The *Nipa fruticans* is a common object in the salt marshes of the islands and coasts in the Indian Ocean, and is a low stemless plant, palm-like in habit. The leaves are most extensively used as a roof thatch, for which, indeed, they are admirably adapted. When burnt the leaves yield salt, the spathe yields toddy, syrup, sugar, vinegar, yeast, or spirit, at the will of the operator. The seeds are edible, being somewhat like cocoanut in taste, the slight insipidity in taste being corrected by sugar.

The true *Pandanæ* are, however, the more interesting. Of the genus *Pandanus*, there are several species, confined to the Eastern hemisphere, being very numerous in the Indian Archipelago, found principally in the vicinity of the sea, and forming one of the "aspects of vegetation." To clear one's way through these almost impenetrable masses, requires a strong arm, a good belt-axe, and, above all, a good temper. Some of the *Pandani* run from 10 to 15 feet in height. The leaves are long, narrow, tough, and leathery, with the edges and midrib armed with sharp recurved spines, which have a most provoking way of intruding in one's clothes or flesh, putting one in mind of the "wait-a-bit" thorn of African travellers. The fruit consists of a number of wedge-shaped drupes, clustered often into large coal-like heads. The aerial roots, too, with their cup-like spongioles, are very remarkable.

The leaves of the *Pandanus utilis* of Mauritius are made into sugar bags, and often are utilised in this country as fish baskets. The fruits of *P. fætidus* are extremely fœtid, whilst those of *P. odoratissimus*, are, as the name would imply, the reverse. It is, however, in the Nicobar Islands where the *Pandanus* is fully appreciated, and holds a position almost equalling that of the cocoanut in Ceylon as a source of food.

In the Nicobars, the *Pandanus* grows to about thirty feet in height, and luxuriates on the banks of creeks and marshy ground, and almost equally as well on undulating grassy plains in the interior. The cone, or head of drupes, attains a length of fourteen to fifteen inches, and a breadth of nine to ten inches, being first of a dark green colour, changing to a dull red on ripening. The ripe fruit is gathered by the natives, the finer sorts being selected for breadmaking, the interior being given to the pigs. The drupes are then separated from each other, and placed in a large earthen vessel, which, when about two-thirds full of nuts, is set on to boil for twelve to fourteen hours, the nuts being kept covered with water during the time. After boiling, the soft dough-like substance which the drupe contains has next to be removed, and is effected in the following manner by women :—They take a shell, and drawing the fruit with some amount of pressure over the edge, force out the amylaceous matter into the shell, which, in the meantime, is held firmly between their toes. The conical-like fibrous brush left is discarded, and fresh fruits treated in the same manner, till a sufficiency of "dough" has been expressed, which is of a pale brownish colour, and largely mixed with portions of the fibrous husk of the fruit. These fibres have next to be removed. To do this, the woman, selecting a long piece of fibre, seats herself on the ground, and fastens one end of the fibre round her right toe, and the other end round one of the fingers of the left hand. Taking the ball of dough in her right hand, she passes the long fibre through it, and dexterously removes all the fragments of fibre, without wasting a particle of the dough.

This dough is either eaten in its present state with fish, or pork, or is made into rough cakes and baked on hot ashes. It forms a very nutritious food, but its peculiar sweetish taste cloys on the appetites of Europeans, though, as a substitute for bread or biscuits, or in the form of a pudding, with the addition of sugar or jam, it is by no means to be despised, and to the Nicobarees, who are not an agricultural race, the fruit of the *Pandanus* is a most valuable staple article of food.—*Journal of the Society of Arts*, September 15.

AGRICULTURAL EDUCATION FOR THE INDIAN PEOPLE.

NOT very long ago, we offered a few observations on the subject of Scientific Agriculture ; and we now purpose following up those remarks with some more on what there can be no doubt is a matter of the utmost moment to the national progress and development of the Indian peoples.

As we stated in our former article, we are, and have long been, among those who hold that the country is neither socially nor pecuniarily fit for the introduction of any such of the reforms in its agricultural system as those we see Government endeavouring to introduce into the 'practising' departments of their Agricultural Schools and Colleges. Not only this, we go further and say that the way in which the powers-that-be have gone to work in the direction of teaching their native subjects to improve the husbandry of the country is hardly the best, if it is not one of the worst, method of executing a peculiarly delicate and difficult piece of business. Leaving aside the remarkably conservative tendencies of the average Hindu cultivator, and the close consequent nearness to impossibility in getting him to take to anything new (which is not on the face of it profitable), it appears to us a little too much to expect that the sending out of a mere handful of young men, with a few years' training, however excellent, among their unscientifically agricultural brethren is likely to produce any great or lasting results. On the contrary it appears to us that the [illegible] of such a system would be just the other way. Your first-class B. A., for instance, is hardly looked up to with any great respect outside his own clique or college ; and yet look at the amount of money he costs the country ; and think, too, of the high hopes which were held by the early champions of the higher education system, as to the graduates of Indian Universities creating a new era, and a glorious one in the history of this country. Well, what guarantee, we ask, have we that the expensive further out-turn of our Agricultural Colleges will be a bit better, so far, we mean, as regards any influence for good on the masses of their fellow-countrymen? We are particularly anxious that we should not be misunderstood. We are by no means of Professor Monier Williams' way of thinking that the average 'educated native' is more or less of an "incarnate curse." On the contrary we are distinctly of opinion that the educated classes of the native community form by far the most hopeful, important, and interesting section of the entire Native Indian Common-wealth. All that we do say, and none could wish more earnestly than we do that we were mistaken, is that the 'educated native' class has not, as yet, been productive of any palpable influence for good on the great bulk of his unenlightened compatriots. Holding, as we have been forced, by experience and observation, to hold, this painful belief, we are most anxious to do what little may lie in our power to prevent the occurrence of similar mistakes, and the foolish, if not positively useless, outlay of money on (so-called) educational schemes.

To hasten on, however, to our subject itself, we may state that we fully admit the correctness of the principle that the agricultural condition, interests, and prospects of so almost entirely an agricultural a country as this is should occupy no small share of the most careful attention of the authorities ; but, knowing that the country is in a greatly impoverished condition, it becomes necessary to consider in what direction steps should be taken with the least possible expense, as well as with the greatest possible benefit to the agriculturalist population.

In the first place, it seems to us above all things necessary that any movement in the direction of agricultural reform in this country should take a thoroughly practical direction. Instead of putting the country to the cost of maintaining expensive Schools and Colleges for agricultural Education—which is not yet a *felt* national want—we certainly think the revenue authorities might, in the course of the constant contact into which they are coming with the agricultural classes, very properly and profitably undertake the introduction of new and improved seed grains, implements, and even cattle. Something of this kind was tried—with success, if we remember aright—during the famine of 1876-77 ; and we only wonder why the experiment has not been made more largely and more generally.

We should also like to see some of our veteran Anglo-Indians settling down to a farmer's life in such places as Bangalore or Coimbatore, where the climate is not so trying to the European, and show their sable neighbours how to do farm-work in a better fashion than that now in vogue. We are sure the example will produce substantially beneficial results. Practice, all the world over, is a far more impressive teacher than precept, as is abundantly proved by the many good (and many bad) things our native fellow-subjects have learned or copied from us.

Such are some of the ways in which, we venture to think, the Government could, more easily and economically, as well as more effectively, do something worth doing for the improvement of Native Indian Agriculture ; and we trust they may commend themselves to those who have it in their power to adopt the same in practice, as well as to all those interested, like ourselves, in the discussion of a subject most intimately connected with the progress and prosperity of this greatest dependency of the British Crown.—*Madras Athenæum*.

SHEEP HUSBANDRY.

PRESIDENT GIBSON, of the Montana Wool Growers' Association, delivered an excellent address at the late annual meeting of that organisation. What he said pertaining to the rapid development of the wool industry in the United States and the difference in price between Australian fine wools and those of the great wool growing regions west of the Mississippi river may be read with profit by wool-growers generally. It is as follows :

"The rapid development of the wool-growing industry of the United States and its territories must satisfy any thoughtful grower that soon more wool will be produced that can be used in the woollen mills of the country. Next to Australia, we are now producing more clothing wool than any other country on the face of the earth. In 1876 our wool product was 115,000,000 pounds, while the present year it will not be far from 350,000,000 pounds. Should this ratio of increase be maintained, you will perceive that the clip of the country will soon reach the enormous quantity of 500,000,000 pounds, nearly all of which is clothing. When we produce more wool than is required to supply our looms, we must export our surplus, and prices will then be fixed by the great market of London, as well as that of Boston. This may not be pleasant to contemplate, but we must be ready for this juncture of affairs, for it will surely come soon. We are now importing, I believe, scarcely 50,000,000 pounds of clothing wool per annum. How can we best prepare for the new conditions of things? Plainly by a more thorough knowledge of our business. We must, if possible, grow our wools at less cost. The all-important point to be gained, however, is the production of wool here in Montana that shall, from its superior condition, take the lead in the American market. Our wool is to-day worth 20 to 28 cents in Boston, while Australian and New Zealand wools are worth 40 to 45 cents. Australia may be a more favored spot for growing wool than Montana, but I doubt it. I find here those subtle influences—whether they spring from the soil, the water or the atmosphere—

that produce the softest and most brilliant clothing wools. I know, from the fact that our wools lead all other territorial wools in the market, although this was the last of the territories to commence wool growing, that nature has kindly given us advantages that she has withheld from other sections of this continent.

Whence, then, arise the wide difference between the English colonial wool referred to and the wool of Montana? Clearly from the difference in breeding and in the manner of preparing the wool for the market. In buying sheep, we are too apt to put them all in the same scale of prices—coarse, medium, and fine. With too many of us it is a question of number, instead of quality. We recognize but little difference between mongrels and the pure descendants of the importations of Humphreys and Jarvis. We commence breeding up and then breed back to where we started from, each grower breeding "on his own hook," regardless of what his neighbours are doing. The result is that in the same district you will hardly find two clips of wool at all alike, and in the same flocks are all grades, from the soft, beautiful XXX wool, down to a coarse, frowsy fleece, fit only for low carpet filling. The average Australian wool grower is constantly improving his hands by the most careful selection. The whole world is ransacked for the choicest and hardiest strains of Merino blood. Vermont annually furnishes a large number of the very best stock rams for English wool breeders, whose stock ranches are ten thousand miles distant. They have thoroughly tested the different types of Merino sheep, and they obtain the best, regardless of cost. Can we wonder, then, that the English colonial wool growers have built up during the present century such a magnificent wool industry in Australia? If we would bring Montana wool to the very front rank at the eastern seabord and create a brisk demand at paying prices in the face of competition of the best wool growers of foreign countries, we must improve its quality by adopting rules of breeding and of flock management heretofore unknown among us. We must weed out our inferior sheep as fast as we can, and send them to the shambles. The best we have must improve by introducing the choicest blood. Fortunately, we in our own country, in the Eastern States, a type of Merino sheep that stands second to none in the world, from which we can obtain, at reasonable prices, stock suitable for the highest improvement of our flocks. At the London wool sale the shrinkage of every lot offered is accurately given and guaranteed, and this method must soon be adopted in our own country. Manufacturers are naturally prejudiced against heavy wools, and consequently they are the last to be sold. Light shrinking wools are always attractive, are sold quickly at full market values. While I am opposed to the introduction of greasy, wrinkly Merinos, I would not be understood as favoring the Saxony or Silesian type of Merinos for Montana. I would recommend a class of Merinos occupying a place between the two extremes. For some of the pure bred flocks of Vermont, Ohio, or Wisconsin you can always select strong, vigorous rams, carrying no wrinkles or folds except upon the neck, and whose wool bears no excess of oil. "When the time comes that the United States produces more wool than our manufacturers require, it will then become among our wool growers a question of the "survival of the fittest." Wool growing, in my opinion, will increase and continue to be a remunerative business in the great pastoral district adjacent to the Rocky Mountains, from Mexico to the British dominions, while the Merino sheep industry at the East will give place to more profitable pursuits or be supplemented by the mutton races, such as the Southdowns and other Downs. The latter theory would seem to be correct when we consider the wonderful growth of the cities from the Atlantic to the Missouri river, and the rapidly increasing demand for choice mutton.—*Breeder and Sportsman.*

THE HIGHLAND SOCIETY'S EXPERIMENTAL FARM.

SEVERAL members of the Highland and Agricultural Society lately visited the experimental station of the society at Pumpherston. The weather was favourable for the excursion. Among those present were Sir James Gibson Craig, Bart.; Mr. Colin Mackenzie, of Portmore; Dr. Aitken, Edinburgh; Mr. Scott Dudgeon, Longnewton; Mr. Wm. Dingwall, Ramornie; Mr. H Lindsay, Meadow Flat, and Mr. Todd, the manager of the station. Dr. Aitken, the consulting chemist of the society, conducted the party over the station, explained the nature of the experiments, and pointed out the more noteworthy results. The field in question, which has been under experimental tillage during the past six years, is, like the other stations similarly dealt with, 10 acres in extent, and is divided into 40 plots of 1 rood each. The cropping is a rotation of turnips, barley, grass, and oats, and the chief object of the experiments is to determine the crop producing value of various forms of the most important manures. The manures on each plot contain 40 lbs. phosphoric acid, 30 lbs. potash, and 10 lbs. nitrogen. It is in the form in which these have been put on that the difference lies. For the present crop of barley the ground, which is a thin, cold clay, was ploughed on the 15th January and 17th and 19th February, and the barley sown on the 23rd April. The manure was sown on the 28th April, and the first braird was seen on the 12th May, and nitrate dressing on a portion of the area being applied on the the 16th June. From the date of sowing to the present time the rainfall has been 13·15 inches, there having fallen from 23rd April to the end of the month, 1·07 inches; during May, 1·35 inches; June, 2·44 inches; July, 4·98 inches and during August 3·11 inches. The mean temperature of May was 57 degrees, of June 59 degrees, of July 67 degrees, and of August 63 degrees. Twelve of the plots had been treated with phosphatic manures, six with nitrogenous manures, four with potash manures, four with guanos, and three with superphosphates, while the remaining plots had been treated with these and other manures in various quantities. The results, in many instances, were very marked, particularly in the difference between the dissolved manures. Dr. Aitkin pointed out that the dissolved phosphates showed an advantage over undissolved phosphates in two directions—namely, that they produced a larger and an earlier crop than the undissolved. In regard to the potash experiments, it was found that the application of the sulphate and of the muriate produced very equal results. As regards the nitrogenous manures, nitrate of soda (with bone ash and sulphate of potash and sulphate of ammonia) were also found to produce very equal results, and the crops treated with them were very good. In the plot in which 'shoddy' had been applied, the crop had evidently not yet felt the benefit of the manure. In an adjoining lot it was found that dried blood had produced a very excellent crop, and it seemed evident that if it had been put on a little earlier, the crop would have been one of the very best in the station. There seemed to be little difference in the results obtained from fish and Peruvian guanos, which produced good crops; but the Ichaboe guano had not quite come up to the mark of the other two. Where no nitrogen had been applied there was found a riper crop than where nitrogen had been applied alone. Where nitrogen had been applied, Dr. Aitken remarked, in the form of nitrate of soda, the crop was the latest and greenest in the station, and, although not the thinnest, would never come to anything like a crop. In some of the plots one or two constituents had been withheld, and it was found that where no phosphates had been used the crop was much later, thinner, and poorer in every way. Where phosphates alone had been used, the crop was earlier, but thin. Where there had been no potash used, the crop suffered at an early period of the season, and had a 'segged' or tulip-root appearance, and was late in shooting. Where potash alone had been applied, the crop was not so deficient as it has been in former years, but still it was very green and very late, and would never come to much. As regarded superphosphates, Dr. Aitken explained that these were applied in three different states of solubility, and although all produced heavy crops, that which was mediumly dissolved had produced the best of the three. Attention was directed to another important feature of the experiments. A large majority of the plots had their nitrogen applied at two different times. One-half of each plot had half of its nitrate of soda put on at the time of sowing, and the other half six weeks later. It was found that the half which had all the nitrate applied at the time of sowing had a much riper and straighter crop than the other. The half which was manured with nitrate six weeks after sowing (the 16th June) had a very bulky crop—too bulky, in fact, for the land. A considerable part of it was much laid, and was later than the other. It would have been better, it was considered, if the second application had not been so late in being made. In view of the questions raised by the Agricultural Holdings Act, considerable interest was taken in two plots in which the effects of previous years' manuring, were still very visible. Dr. Aitken, while conducting the party over the field, read a letter which he had received from Mr. P. M'Laggan, M.P., who was prevented by another engagement from being present. Mr. M'Laggan wrote:—'I have been examining the experiments, and I have learnt something from them, and I have had my opinions confirmed on certain points. I observe that where nitrate of soda is applied by itself the crop is later. This I have always found to be the case. I observe that this year the crop is better where there is the largest quantity of soluble phosphates; and it is earlier where the phosphates are dissolved. I have no doubt you will be able to point out more results worth noting, and I can only regret that I shall not be present to hear them.' The plot which was considered to have the best crop was one which had been treated with dissolved bone dust with muriate of potash and nitrate of soda, the crop being reckoned at 40 bushels per acre. Decorticated cotton cake had produced a very good crop, which had ripened quickly, and was regarded as much superior to the produce of rape seed dust with which another portion of the same plot had been treated.

VEGETABLE EXTRACTS.

WHILST it is admitted on all hands that the cultivation of economic plants, yielding sugar, fibres, and drugs, and their by-products of all kinds, according to the climates and soils suitable to their cultivation, might be profitable, the obstacle that the grower and the capitalist alike have had to face, has been the almost insuperable difficulty of extracting the several products at a cost of production that will leave a profit at all commensurate with the risk incurred. When we take into account the amount of unprofitable vegetable matter associated with the more valuable part of the plant to be dealt with, the cost of labour and carriage of the crude material to the nearest mill and the comparatively poor results, the costly and by no means perfect machines return upon the outlay, we are the less surprised to find how quickly the enthusiasm of the most hopeful is cooled after the first or second essay in any of these directions.

The efforts made by the Government of India to improve the condition of the fibre producers, who had expended large sums in cultivating 'china grass,' affords us a capital illustration. Their evident desire to promote on a larger scale the cultivation of plants which from time immemorial had produced valuable fibres for native textile fabrics, led the Indian Government to offer a prize of some five thousand pounds sterling for the production of a suitable machine to remove the fibre from the woody matter associated with it, in the *Rhamia* plant particularly. It was in the year 1870 the offer was made. The machine was to be of such a character that it could be used in the rainy season, when the plant was still green, at a time when the

difficulties of heating the plants are insuperable except by artificial means. The first trial was made at Saharunpore in 1872. The results obtained were considered unsatisfactory; but Messrs. D. and J. Greig received a prize of £1,500 for a crushing machine then shown. The trials were postponed for some years, and at the second contest, in 1880, no less than twenty-three competitors presented themselves. The ruling idea was a crushing machine. Exhibits from England, America, France, Denmark, Hungary, Java, New Zealand, and India were represented, but in no case could a machine be found that would "extract the fibre from the brown exterior pellicle and from the excess of agglumenative gummy matter which holds them together in such a manner as to produce an article whose value in London shall not be less than £45, and of which the cost of production shall not exceed £15 per ton of fibre obtained." Crushed stems, in fact, no matter how deftly treated by mechanical means, refuse to surrender their more delicate filaments (and these are the most prized), and only give up their coarser constituents, in a more or less mangled form, when subjected to the clumsy ordeal they have undergone. All at once, and that not so very long ago, the chemists who had been investigating the progressive action of fermentation in plants in cold and warm water, obtained a clue to the laws which seem to regulate the process of vegetable decomposition, and did not fail to observe that as the temperature was raised the adherence of the internal ligneous part and the cortical envelope is destroyed, and the separation of each of the different concentric layers which form the wrapper is effected. The fibre-bearing plant is provided with three zones in the bark, consisting of the epidermis and a thick layer of parenchyma, which contains the chlorophyllum of the plant, then a larger layer of cortical fibres, generally isolated and independent of each other; the last zone is contiguous to the cambium in which are the finer fibres, and associated with these there is an abundance of small crystals of carbonate of lime; it was found, that if the stems were subjected to superheated steam or some such calorific agent, the moisture could be drawn off effectually in a few minutes by the addition of some chemical re-agent and the fibres extracted free from any kind of adhesive particles that would render it unsaleable, there was an end to all obnoxious or tedious "retting" or "stripping" processes, and the object of their search was attained. During the last four years steady progress has been made in rendering the operation perfect and profitable, and at a cost which will be hardly felt when the value of the fibre comes to be submitted to the manufacturer; similar experiments have been made in England, France, and America. The work commenced in France by the well-known M. A. Favier has been improved upon by the distinguished chemist M. Fremy. In England much attention has been bestowed upon the subject, whilst American chemists have contributed their share. Side by side with these discoveries of such incalculable value to the commerce of the future, chemists in the north of Europe, in America, France, and England, were making equally rapid progress in perfecting new methods of extracting saccharine matter from sugar cane, sorghum and maize plants. The old and cumbrous process of extracting sugar from cane by elaborate and costly machinery, always most profitable to the manufacturer, but which after all gave only a poor return to the grower, had this effect amongst others, of forcing the production of beet root and other kindred saccharine plants upon the market in competition with our colonial trade, was admitted on all hands to be defective and unprofitable. Other means have now been found by which pure sugar and syrup can be drawn direct from the sugar-producing plants we have indicated. By this new departure costly machinery is dispensed with, and the land in some instances, without overtaxing its power of production, can be made to give a continuous yield of sugar-producing plants. Crushed cane with its poor return in sugar, molasses and treacle will become things of the past. The American Department of Agriculture, ably supported by chemists of known experience have superintended for the last four years the new method of extracting sugar by a simple chemical operation, and at a cost which, including the cultivation of the plants, at first sight may seem simply incredible, until the tables of expenditure and profit are consulted, when all doubts are dispelled by the evidence they contribute. It appears by the published report of the United States Department of Agriculture at Washington that—"Eighty batches of syrup taken by the manager from the finisher in the consecutive order of production made from cane and stems of all conditions, good, bad, and indifferent, show an average of 66 per cent of crystallized sugar. Several of the best show as high as 80 per cent. All would have shown this high average if all the cane had been good." In England like results have been arrived at, as we have already shown in the pages of this journal, and it is possible when the researches now under observation and exhaustive trial have been perfected, as they assuredly will be before long, that a perfect revolution in sugar production will be effected. Nor has the investigation of methods for extracting these products by chemical means limited the field of operation; these same chemical studies have led to others of equally high commercial importance. The same or equally simple methods will be applied to the extraction of dye stuffs and other alkaloids with apparatus, which, we gather, is of the simplest and most inexpensive character.

It is not possible to estimate the enormous value of these discoveries. Their future effects upon planters' prospects is evident. A new impetus will be given to tropical and even European agriculture. The cultivation on a large scale of fibre and sugar-bearing plants, which languished of late for want of some ready means for their ultimate utilization, is obvious. Capital which hitherto has been only too grudgingly invested in such enterprises will flow into channels which undoubtedly will yield large returns. Lands which have proved capable of producing such forms of vegetation without stint, and have relapsed into their former state of sterility, will again be taken up, and employment will be found for many who are at present eagerly looking forward to participate in the fruition of such remunerative enterprises as these, both at home and abroad.—*Planters' Gazette*, September 15.

CINCHONA.

THE GOVERNMENT CINCHONA PLANTATION IN BENGAL.

THE following is the Resolution of the Government of India, on the Annual Report of the Government Cinchona Plantation in Bengal for the year 1882-83, and the Annual Report of the Quinologist for the same years. The result of the planting operations of the year shows a decrease of about 50,000 cinchona trees on the returns of 1881-82. This is due to the uprooting of a large number of the *Calisaya* and hybrid varieties which were found to possess bark of poor quality. Some 160,000 red-bark trees were also uprooted in the ordinary rotation, and were replaced by the yellow bark and hybrid varieties. Nearly all the land within the existing cinchona reserve suitable for cultivation has now been planted out, and the Superintendent accordingly applied, in October last, for permission to plant out with *Ledgeriana* and the hybrid variety a tract of land in the trans-Teesta portion of Darjeeling which had been reserved for Government cinchona cultivation. Both these species have been proved by repeated analyses to be very rich in quinine, while most of the yellow bark or quinine-yielding trees on the existing plantations at Mungpoo are quite young, and the whole stock is not sufficient to furnish, even when mature, enough bark to employ the factory profitably for more than a few weeks in the year. There is, in fact, no plantations of these trees actually in existence, while the nurseries have a magnificent stock of nearly half-a-million plants of the best sorts of yellow-bark trees which would be lost unless the seedlings were speedily planted out. The proposal for forming the new plantation was readily approved by Government, and measures have since been taken for planting out the reserve with a number of the best kinds of *Ledgeriana* and hybrid cinchonas.

In the Resolution recorded upon the proceedings of last year, it was remarked that there were several distinct forms of the hybrid variety, and analyses were given of the samples of bark of four of these forms. During the year under review the Superintendent had analyses made of four more of these forms, and the results obtained from all the eight hybrids are compared in the following table:—

	No. 1.	No. 2.	No. 3.	No. 4.
Crystallised sulphate of quinine	2·87	1·48	1·88	0·97
Crystallised sulphate of cinchonidine	2·94	2·85	2·93	1·94
Crystallised sulphate of quinidine	Traces.	Traces.	Traces.	Traces.
Cinchonine (alkaloid) ...	0·72	0·57	0·52	0·80

	No. 5.	No. 6.	No. 7.	No. 8.
Crystallised sulphate of quinine	2 12	2·04	6·12	3·99
Crystallised sulphate of cinchonidine	2·84	2·26	2·46	3·33
Crystallised sulphate of quinidine	Traces.	Traces.	Traces.	Traces.
Cinchonine (alkaloid) ...	0·33	0·68	0·55	0·57

Dr. King points out that hybrid No. 4 is very poor quinine, and it was the trees of this sort that were uprooted during the year. No. 7 appears to be exceptionally rich in quinine, and the plantations of this variety might with advantage be extended.

The total number of cinchona trees of all sorts at the close of the year was 4,711,168, namely, red (*Cinchona Succirubra*) 3,713,200, yellow (*Calisaya Ledgeriana*) 662,936, hybrid unnamed variety 304,378, and other kinds 30,592.

It is satisfactory to observe that the crop of the year is the largest that has yet been harvested on the plantations. It

amounted to 396,980 pounds of dry bark, of which 372,610 pounds were of *Succirubra*, 22,120 pounds of *Calisaya* and *Ledgeriana*, and 2,250 pounds of hybrid bark. By far the largest portion of the produce was made over to the factory for conversion into cinchona febrifuge, while about 41,8000 pounds of yellow and red barks were sent, at the request of the Secretary of State, to London to be there converted into various forms of febrifuge, and returned to this country for trial by the Medical Department.

The expenditure on the plantations amounted to Rs. 80,739-6-2, against the budget allotment of Rs. 82,225. Of this expenditure Rs. 17,548-3-9 was incurred on the newly-opened trans-Teesta plantation, and on the young plantation at Sittong. This sum is chargeable to capital account. The balance, amounting to Rs. 63,191-2-5, which was spent on the old plantation, and includes charges on account of packing and carriage of bark sent to England, is chargeable as working expenses.

It is disappointing to notice the continued failure of *Carthagena* bark, notwithstanding that the utmost care has been taken of the plants and every endeavour made to grow them at various elevations and with various exposures. Only three plants were alive at the close of the year. An attempt has been made by the Superintendent to introduce the *Remija* plant, which is a genus botanically allied to cinchona. It is said to be less particular than cinchona as to soil and climate, and produces a quinine-yielding bark under the name of *Cuprea*. This bark forms a very large proportion of the quantity of quinine bark imported into Europe. Although the first attempt to grow the plant in the Mungpoo plantations has not been quite successful, Dr. King entertains hopes of successfully acclimatizing it, when he is able to procure a more adequate supply of seed. The Lieutenant-Governor will await the result of the experiment with much interest. The surplus seed of the *Calisaya Ledgeriana* was, as usual, distributed during the year gratuitously amongst applicants.

Dr. King has eventually succeeded in obtaining an analysis of the bark renewed on *Succirubra* trees that had their original bark removed by the shaving process introduced by Mr. Moens, the distinguished Director of Cinchona Cultivation to the Dutch Government. It appears that this process consists in shaving off the greater part of the bark of a living tree to the height of from 8 to 10 feet from the ground, care being taken to leave everywhere a sufficiently thick layer of bark to cover the wood. This method has had a fair trial on the Sikkim plantations, and the result has, beyond doubt, been favorable as the bark renews perfectly. What, however, remained to be seen, was whether the renewed bark was as rich in medicinal alkaloids as the original. It was with the object of determining this question that the analysis above referred to was undertaken during the year. The results are thus described by Dr. King: "The bark renewed rather slowly, but the analysis shows that it is very rich both in quinine and cinchonidine; and there can be no doubt that in countries where red-bark trees are perfectly at home, and where their continuance in good health and vigour for a long series of years can be absolutely counted on, this shaving process must be a very excellent one."

An interesting feature in the operations of the year is the low cost at which the febrifuge was turned out. The price of the febrifuge necessarily fluctuates from year to year, but in no former year has it been so low as Rs. 8-8-0 a pound. This satisfactory result is attributed chiefly to the larger percentage of the alkaloids (2·73) extracted from the bark used in manufacture. The issues, however, fell below those of 1881-82, though they were a little in advance of those for 1880-81. The following table compares the distribution in the past three years:—

	1880-81.		1881-82.		1882-83.	
	lb.	*oz.*	*lb.*	*oz.*	*lb.*	*oz.*
To Medical Depôt, Calcutta	3,000	0	3,386	0	2,000	0
Do. do. Bombay	2,000	0	1,000	0	1,000	0
Do. do. Madras	500	0	800	0	350	0
To Colonial Government, Mauritius	...		...		150	0
To Surgeon-General for District Medical Officers of Bengal	...		995	4	803	12
To Inspector-General of Jails for Jails and Lock-ups, Bengal	...		14	12	26	12
Sold to the public ...	3,150	11	4,680	0	4,560	12
Given as samples ...	3	2	2	9	10	0
Total ...	8,653	13	10,878	9	8,901	4

The issues to the public were 120 pounds below those of 1881-82, and not in excess of that year, as stated in the Superintendent's report. The stock of febrifuge in hand on 31st March 1883 amounted to 2,062¼ pounds, which, though greater than that with which the year opened, is by no means too large a reserve to meet emergencies.

The revenue derived from the sale of the febrifuge, seed, plants, and bark amounted to Rs. 1,52,807-1-0—

	Rs.	A.	P.
By sale of febrifuge, seed, plants, and bark to the public	80,577	9	0
By credits from the Medical Depôt of Calcutta...	33,766	0	0
Do. do. do. of Bombay...	16,500	0	0
Do. do. do. of Madras...	5,775	0	0
Do. from Colonial Government of Mauritius	2,475	0	0
Do. from the Surgeon-General Bengal ...	13,271	8	0
Do. from the Inspector-General, Jails ...	442	0	0
Total ...	1,52,807	1	0

The operations of the year resulted in a profit of Rs. 66,284-9-5, which is equal to a dividend of 6½ per cent on the capital outlay. This is exclusive of the cost of a considerable quantity of the bark sent to the Secretary of State which has not been taken into account. It must, moreover, be borne in mind that these profits do not represent the whole of the gain of the year. The cost of an equal quantity of quinine at Rs. 96 per pound would have been Rs. 4,01,328. The cost of the febrifuge used was Rs. 68,988-8-0. There was thus a saving of Rs. 3,32,340. The total saving effected since the opening of the factory by the substitution of the febrifuge for sulphate of quinine amount to Rs. 23½ lakhs, which is more than twice the amount of the cost of the plantations.

Considerable attention was given during the year to the improvement of the process of manufacture. The present system is admittedly wasteful, in that it fails to convert into febrifuge the whole of the alkaloids which the bark contains, while there is no doubt that by the adoption of a different and more costly process of manufacture a still larger percentage of the medicinal alkaloids could be extracted. It is not, however, equally certain whether the febrifuge so obtained could be turned out at a less cost per pound. The whole subject of the course to be adopted in the disposal of the raw produce of the plantations is still under the consideration of Government.

THE SIKHIM CINCHONA PLANTATIONS.

To any one visiting the Darjeeling district, an expedition to the Government Cinchona Plantations is most interesting. Mungpoo, where Mr. Gammie lives, is about 17 miles from Kurseong. The road runs a long the top of a ridge of the mountains for a considerable distance and is a beautiful ride. It is mostly through forest, abounding in ferns and orchids of infinite variety, and of different forms to those commonly found in Ceylon. The Government cinchona plantations occupy a vast stretch of country, and are under the charge of several Europeans. The soil is in most places very rich and remarkable free and porous, whilst the general features of the country are steep and bold to a degree. The most noticeable plantation is one of hybrids near the superintendent's bungalow. These trees are about four years old, and are raised from seed of the original hybrid or "Ignota" trees which appeared in the parcel of seed formerly sent from Hakgala to Darjeeling. Eight forms are recognized amongst these trees as being distinct and characteristic, and representatious of each have been analyzed with the result of figures ranging from ·97 to 6·12 crystallised quinine sulphate. The worst of these forms, known as No. 4, has been entirely eliminated from the plantation, so that its flowers shall not contaminate those of the more valuable kinds. It is characterized by large light green leaves, and is the form which most nearly resembles succirubra in appearance. The richest for, No. 7, giving 6·12 crystallised quinine sulphate, is a small broad-leaved free-growing tree, with some officinalis characteristics. At a considerably lower elevation than this is situated the famous Ledgeriana plantation. These trees are not as large as one would expect from their age, they having been raised from cuttings of the original trees from Ledger's seed. Their most remarkable characteristic is the great girth of the stem and the extreme thickness and weight of the bark, which can be taken off literally in slabs. These trees were all covered with blossom when I saw them, and promise a very abundant crop of seed shortly.

In another portion of the plantation is a Ledgeriana clearing, the plants in which were raised from seed. A strange feature in this planting is the large number of Calisaya Javanicas amongst the

rue Ledgerianas They are, although only about three years old, blossoming profusely, and are easily recognizable by their large flowers and flower branches. The general appearance of the cinchonas is rather disappointing, the growth not being equal to what we are accustomed to in Ceylon, but the wholesale dying out to which we are so liable appears to be little known. I hear canker is very common, but it is purely local in its effect and does not necessarily kill the tree, or materially affect its growth. Mr. Gammie has found a marked falling-off in the growth and general health of the cinchonas, the original trees being superior in every way to those raised from them, and the successive planting being each inferior to its predecessor. This appears to be a very general impression in Ceylon, and it is interesting to note that, in spite of the extreme care and liberal expenditure bestowed in the Government cinchona gardens, this experience in regard to them has been the same as in our case. As with us too, the hybrid cinchonas are markedly superior in growth and general health to the succirubras alongside them, and in consequence, their more valuable forms are alone being propagated in addition to the Ledgerianas which occupy the first place. The system of cultivation pursued is what has been described before except that hoeing is dispensed with. The jungle is allowed to grow freely under the trees and is kept within bounds by periodical "cuttings." Terracing has been tried, but was not found a success, and the terraces are now being levelled in consequence. All the plantations hitherto are on what we should call "chena" land, but the soil is so rich that the trees do not appear to suffer in any way from exhaustion of soil. The cold tweather of last winter, which damaged the branches of the forest rees near the Darjeeling station to such a great extent by the weight of snow on them, appears to have killed back many of the succirubra primaries, which have a strange appearance in consequence. It is striking that in spite of the wonderful financial success of this undertaking, and of the Darjeeling Cinchona Company, which exactly faces Rungbee and Mungpoo across a wide and deep valley, none of the Darjeeling Companies have embarked in cinchona cultivation to any great extent. A few young trees are to be seen along road sides in some places, but anything resembling what we should call a clearing is unseen. It is no doubt fortunate for us in Ceylon that this cultivation has not been largely extended by private individuals in the Darjeeling district, for with the large amount of suitable land which could no doubt be found, and with the comparative immunity they enjoy from premature dying out, we should be faced with a formidable rival to what is now a struggling enterprise owing to low prices. Another point in which Darjeeling experience coincides with ours is regarding the utilisation of land for a second crop of cinchona. This appears to have been a failure when tried, and, in consequence, all such land is, in the Government territory, planted up with timber trees, and, when private land, with tea. I was told that tea planted in old cinchona land did not flush as freely as that in the original chena, but probably a more extended experience will show that when the tea roots penetrate deep into the subsoil this inferiority will disappear.

There are some very fine Ledgeriana plants in the various nurseries, said to be nearly half-a-million in number, and in order to dispose of these, a new plantation, at a distance of 40 or 50 miles across the Teesta river, has been formed for their reception. I was shown some plants raised from so-called "calisaya" seed sent from Jamaica by Mr. Morris, and which it now appears are ordinary officinalis. It seems strange that such a mistake should have occurred, but, apparently, the Jamaica "calisaya" trees which we have heard about must be what we know as "officinalis."

Carthagena bark plants have been tried at various elevations and in various localities, but without success. There was one specimen left near the bungalow which did not look healthy, and which it is to be feared will soon succumb.—*Ceylon Observer.*

THE CINCHONA INDUSTRY IN BENGAL.

We have before us the Annual Report on the Government Cinchona Plantations in Bengal for the year 1882-83 From this we gather that the Government possess four millions, seven hundred and eleven thousand one hundred and sixty-eight cinchona trees of sorts in the sister presidency, and that these are doing as well as can be expected, considering the comparatively embyro stage in which the cultivation of the quinine bark tree is at present in this country. The above total is exclusive of sixty-three thousand six hundred and ninety-seven trees which were uprooted during the year under review, as the analysis showed that the bark was of poor quality. Of these discarded trees twenty thousand were *hybrids* and forty-three thousand six hundred and ninety-seven *calisayas.* The removal of these inferior treest is in conformity with the policy which has been followed for some years of raising the standard of the produce of these estates by cultivating only the finest kinds of quinine-yielders. In conformity with the same policy, one hundred and sixty thousand and eight-five red bark trees, which had to be uprooted in the execution of the above system, were replaced, not by red barks, but by yellow barks and *hybrids.*

The crop for the year is the largest that has yet been harvested on plantations in question. It amounts to three hundred and ninety-six thousand nine hundred and eighty pounds of dry bark, of which thirty-eight thousand eight hundred and eighty pounds were from comparatively young plants, and the rest from matured trees. Of the total crop, three hundred and seventy-two thousand six hundred and ten pounds were *Succirubra*, twenty two-thousand one hundred and twenty pounds were *Calisaya* and *Ledgeriana*, and two thousand two hundred and fifty pounds were *hybrid* bark. The crop was harvested by two methods, one hundred and eighty-two thousand seven hundred and twenty pounds having been procured by uprooting trees that had begun to mature, while the remaining two hundred and fourteen thousand two hundred and sixty pounds were got by thinning the plantations at spots where the trees had begun to crowd each other. The bulk of the crop was made over to the factory for conversion into cinchona febrifuge, but twenty-seven thousand eight hundred pounds of yellow bark and fourteen thousand pounds of red bark were sent home to the Secretary of State, by whom the consignment has not yet been accounted for. It is, we believe, intended that these forty-one thousand eight hundred pounds of bark should be converted in London into various forms of cinchona febrifuge, and that these shall be sent to this country for trial by the Medical Department. The results of this experiment should prove a great success both financially and otherwise. Including the crop of last year, the total outturn from these plantations since their formation, are, we are informed, considerably over two and-a-half millions of pounds of dry bark. The Government may therefore be congratulated on possessing a very valuable property indeed in the Cinchona Plantations of Bengal. The budget allotment for the year was eighty-two thousand two hundred and twenty-five rupees, of which only eighty thousand seven hundred and thirty-nine rupees were spent, thus leaving a balance of one thousand four hundred and eighty-five rupees on hand of the allotment. In return for this outlay, three hundred and ninety-six thousand, nine hundred and eighty pounds of bark were harvested, and delivered over to the factory at cost price. The cost price is calculated at two annas and nine pies per pound of bark. The cultivation of the *Carthagena* bark appears to have been a decided failure, as only three plants remained alive out of a large number at the end of the year. Nothing could well have been more disappointing than has been the attempt to introduce this bark. The plants when received from Kew appeared to be in fine condition, and grew at first vigorously, so much so as to lead to the belief that the species would be easy of cultivation, gradually, however, all the plants, with the exception of three, sickened and died. Every care was taken of them. Individual plants were tried at various elevations and with various exposures, but the results have been uniformly disappointing. *Cuprea*, a quinine-yielding bark, imported into the London market from South America did not give more encouraging results to the effort to domesticate it in Bengal. Out of a single packet of seeds which was all the Superintendent could obtain, only one solitary seedling was raised. We are assured, however, that this cultivation will be persisted in until the plant is acclimatised. The supplies of *Cuprea* bark to the home market have so steadily increased, that now this description of bark constitutes by far the largest proportion of the total quantity of quinine bark imported into Europe. For a long time the botanical origin of *Cuprea* was unknown, but it is now ascertained to be the produce of a species of *Remija*, a genus botanically allied to Cinchona *Remija* is said to be less particular than cinchona as to soil and climate, though the unsuccessful attempt to introduce it into Bengal does not bear out this inference. The Government very wisely and liberally distributed the whole crop of seed of *Cinchona Ledgeriana* gratuitously to applicants. We know that the boon of this free distribution has been much appreciated by planters all over India as well as in Ceylon. The percentage of febrifuge extracted from the bark treated in the factory was 273. This is stated to be a better result than that obtained last year, and is attributed to the superior quality of the bark used in the manufacture. The net result of the manufacture for the year was an outturn of ten thousand three hundred and sixty-three pounds of ordinary, and three hundred pounds of crystalline febrifuge. The cost price of febrifuge, which necessarily fluctuates from year to year, has in no former

years been so low as Rs. 8-8 a pound, and this is attributable to the larger percentage of the alkaloids extracted from the bark used in manufacture. We note that the year's working resulted in a profit of sixty-six thousand, two hundred and eighty-four rupees, which is equal to a dividend of six and-a-half per cent on the capital, a result which is very satisfactory and demonstrates the lucrativeness of Cinchona planting. Quinine ruled throughout the year at an average of ten shillings an ounce in London, which, calculating exchange at one shilling, eight pence per rupee is equal to rupees ninety-six per pound in India. The quantity of febrifuge supplied to Government Departments, during the year was four thousand, one-hundred and eighty and-a-half pounds, and the cost was sixty eight thousand nine hundred and eighty-eight rupees. An equal quantity of Quinine at rupees ninety-six per pound would have cost four lacs, one thousand, three hundred and twenty-eight rupees. The saving to the State effected by substituting febrifuge of Government manufacture for English-made Quinine was therefore three lacs, thirty-two thousand, three hundred and forty rupees. If this be added to similar savings effected by the substitution of the febrifuge for Quinine in former years, the total saving to the State in the matter of Quinine amounts to above twenty-three lacs and twenty-five thousand rupees, and as the total cost of the plantations has only been ten lacs, the Government have good reason to be satisfied with the success of its Cinchona operations. Great attention had been given during the year to the improvement of the process of manufacture, and a better result was obtained than from any previous year. There is no doubt that by the adoption of a different and more costly process of manufacture, a still larger percentage of febrifuge might be obtained, but that the febrifuge so obtained would cost less per pound is, we are informed, doubtful. With a raw material which is cheap, bulky, and practically unlimited in supply, processes of manufacture which involve expensive carriage and apparatus are of doubtful advantage. The vexed question regarding the stripping *versus* the shaving systems is given by Dr. King in favour of the latter. However, we do not think that partial experiments like those inaugurated by Dr. King will carry much weight. Dr. King based his dictum on the first shaving of the trees, which yielded a very favourable result, but the opponents of the system declare that the bark deteriorates in an alarming manner after each harvesting of crop, where shaving has been adopted. Be this as it may, the Director speaks in unqualified praise of the Dutch process of harvesting the bark. This was introduced by Dr. Moens, the Director of Cinchona cultivation, to the Dutch Government, and consists in shaving off the greater part of the bark of a living tree to the height of from eight to ten feet from the ground, care being taken to leave everywhere a sufficiently thick layer of bark to cover the wood. This method is alleged to have had a fair trial, and the result has, it is stated, been highly favourable, as the bark renews perfectly. What, however, remained to be seen was whether the renewed bark was as rich in medicinal alkaloids as the original. It was with the object of determining this question that an analysis was undertaken during the year. This results are thus described by Doctor King: "The bark renewed rather slowly, but the analysis shows that it is very rich both in Quinine and Cinchonidine, and there can be no doubt that in countries where red bark trees are perfectly at home, and where their continuance in good health and vigor for a long series of years can be absolutely counted on, this shaving process is a very excellent one." In conclusion, we must remark on the excellent care and management bestowed on the plantations by Dr. King. They could not be in more perfect order, and the Doctor well merits the commendations and thanks uttered by the Lieutenant-Governor.

FORESTRY.

RUBBER CULTIVATION IN CEYLON.

ANOTHER clever contrivance has to be added to the long list of inventions by Ceylon planters for the more rapid, economical and successful performance of the work connected with the cultivation and preparation of new products which, of recent years, have excited so much attention. But first of all, it is satisfactory and re-assuring to find Ceara Rubber trees brought forward again as objects promising financial success for the cultivator. So much was said lately of the difficulty of collecting the milk—or rather watery substance—to make it pay, that on many sides the cry was heard that Ceara Rubber trees were no good, and could not be made to pay, whatever might be the case with the other varieties. The Ceara trees to which the following experiments refer are growing on Peradeniya Estate from 3½ to 4 years old, 28 to 38 feet in height, planted 12 feet by 12, and already with their branches so interlocked that there is dense shade beneath. Mr. Gilliat, the manager, has a strong opinion from the result of his observations and experiments that shade is inimical to the quality of the rubber got from the stem, and he would recommend planting 15 by 15 feet or even 20 by 20 as an experiment. Again, he has found that the best time to cut or tap is immediately after rain, and Dr. Trimen fully agrees that the flow of sap will be greatest just before the flowering season.

The great *desiderata* hitherto with all who have experimented with rubber trees in Ceylon have been a satisfactory, economical mode of tapping the tree without injuring it, of collecting the milk, and of securing it in a marketable form without the admixture of foreign substances or impurities of any kind. Mr. Dobree's knife was intended to be used for the removal (and replacement) of a portion of the bark—an operation which could scarcely be done without injuring the cambium. Mr. Wall tried skinning the tree, and then pricking it to induce the flow of the milk—a tedious and expensive process we should suppose. Certainly we have seen no instrument and heard of no means of tapping equal to that which Mr. Gilliat (the inventor) brought under our notice to-day. By his little instrument, with the accompanying tins and the process for the elimination of impurities, we are very hopeful Ceara Rubber cultivation may be made a very profitable branch of new products' industries in Ceylon, and we trust Mr. Gilliat's ingenuity and patient experimentalizing will meet with the reward they deserve. Suffice it to say that a cooly with this little knife can make the requisite number of cuts down the bark of the rubber trees with ease and rapidity without any material injury to the cambium. When made, the cut is about ⅛th of an inch open or wide by 1-16th inch deep; the cuts should not be nearer each other than nine inches—that is, trees on Peradeniya, four years old, 36 inches girth, take four horizontal cuts; but Mr. Gilliat is very hopeful (and Dr. Trimen we believe agrees) that after a month's interval, four more cuts in the intervals may be made without injuring the tree, so giving a second harvest of rubber. An ordinary cooly can go over 200 trees a day with 4 cuts in each, and a little podian can follow with the tiny tins (specially made by Mr. Gilliat out of empty kerosine tins) which are stuck into the tree to catch the exuding rubber. Those tins can be made at 5 cents a piece. The most important part is however the chemical process by which all impurities are precipitated and lumps of pure white rubber, gradually assuming the pink colour on the edges so prized at home, are secured. Mr. Gilliat, being more or less of a chemist, had experimented for months over this, until he found the spirit, a very little of which dropped into the day's gathering of rubber, secures the above result. The elimination is secured even if 24 hours elapse between the tapping and the application of the spirit. Dr. Trimen is highly satisfied with the result; and we cannot help thinking that the beautifully white clean samples of rubber shown to us to-day will be priced as high as any in the home market. Mr. Gilliat is to lay them before the Planters Association. So far as his experiments have gone, from ⅜ths to ½ ounce of rubber per tree is about the gathering or say ⅜th ounce from the two cuttings with a month's interval. No one can yet say how soon the tree will bear another harvesting. The experiment has to be made; but there is no reason to doubt a satisfactory profit from rubber cultivation, when harvesting and preparation are done with the instruments and according to the plan invented by Mr. Gilliat of Peradeniya estate, to whom all rubber planters owe, at least, their best thanks.—*Ceylon Observer.*

FOREST POLICY IN CEYLON.

MR. VINCENT in his report on Forest protection in Ceylon says:—In the various reports regarding Ceylon forests, and in consulting Government officials and others, there are two opposite opinions as to the future treatment of the forest question. One party thinks that forest devastation has already gone so far that no remedial measures can be of much use in saving the remaining forests; that so called civilization having swallowed up all the forests in the vicinity of towns, and that as timber is so difficult and expensive to get from the remote forests still remaining, the latter should be left to the present management, and that for our future timber supply we should plant up with teak large areas contiguous to our towns. The opposite party would have the whole

of the forest area declared a reserve, all works of improvement—such as planting and thinning—abandoned, and all efforts concentrated on strict conservancy, which would be enforced by a stringent law protecting all Crown forest lands, not only from the chena cultivator, but excluding even village communities from the right of use in the adjacent jungles. Neither of these proposals appears to appreciate the true state of the case. To confine our attention entirely to planting would mean that the forests now left must gradually be absorbed by chena cultivation. We might then find out that teak would not grow, and certainly that its artificial growth would be most costly. On the other hand, to neglect all works of improvement, planting, thinning, &c., as at present, would mean that the forests must gradually deteriorate, and the supply of timber decrease. Past attempts at strict conservancy over the whole area have not been reassuring, and to be effective they would mean an enormous protective staff, costing more than the forests under the most favourable circumstances, could ever return. The true solution of the forest question is only to be found by combining strict conservancy over a limited area—assisted by works of improvement, planting, &c.—with general conservancy over the remainder of the Crown lands. Instead of attempting conservancy over the whole area, it is proposed to limit the sphere of our principal operations to the areas best suited for forming into reserved forests. With regard to the rest of the area, we shall only maintain a general conservancy, preventing the cutting of four or five of the most valuable trees; stopping also the clearing of forest and the unauthorized sale of forest produce, but, beyond this, giving villagers and other local residents as many privileges as they now enjoy. For their better protection it is also proposed, if necessary, to form certain areas into village forests for the benefit of village communities only.

MINERALOGY.

COAL AND IRON INDUSTRIES OF RUSSIA.

H. M. SECRETARY of Legation at St. Petersburg says that until the year 1850 the working of coal was almost entirely confined to the basin of the Don, and the out-put was only about 3,000,000 poods—the pood being equivalent to thirty-six English pounds—of anthracite yearly, the result of private enterprise. The coal-fields in the Ural, the Caucasus, and in the Island of Saghalien produced at the same time but 5,000,000 poods annually. As regards the situation of the various coal deposits, that in the Government of Moscow is considered the most useful taking into consideration the gradual destruction of the forests in Central Russia: that of the Don basin, by the ease with which it can be brought into connection, by means of railways, with the North of Russia, and especially with the Volga and Black Sea, furnishes the railways and steamers plying on the above mentioned river with a considerable supply of fuel. The coal deposits in the Ural Mountains are situated in the centre of a country rich in minerals of every sort, and their close proximity to the River Kama will admit of their being the source from which fuel will be drawn for the use of steamers on that river and on the Volga. In the centre of the beet-root sugar producing country about Kieff and Elizabethgrad, is another vein of coal; and there is also one in the centre of the great mineral deposits of those mountains. With the increase and improvement in railway communication, the output of coal has shown a marked increase. For 1868, the output of Russia—Poland excepted—was 12,000,000 poods; in 1870, 22,000,000 poods; in 1872, 48,000,000 poods; in 1874, 54,000,000 poods; in 1876, 83,000,000 poods, in 1879, 112,000,000 poods, and 1880, 122,000,000 poods. The chief obstacle to the more general use of coal throughout the empire is the excessive dearness of transport by rail, which frequently even surpasses the actual price of the coal. Of 2,700,000 poods of coal worked in the southern portion of the basin of the Don, the production suddenly ran up to 9,500,000 poods in 1872; but in 1874 it was reduced to 3,000,000 poods a year. Since the construction of the Koursk-Kharkoff-Azof Railway it has increased to such a degree that in 1879 it reached 47,000,000 poods. As regards anthracite on the eastern part of the basin, from 4,500,000 poods in 1863, it has increased to 10,500,000 poods in 1877, and in 1879 the total production of this basin was 70,500,000 poods, of which 29,500,000 was anthracite. In the Ural basin, the output of coal was from 1,500,000 poods in 1878 to 4,000,000 poods in 1879. The principal places worked at present are Lounieff and Korchoun-Lazareff. There are also in Asia vast deposits of coal, at Kouznetsk, in the Province of Tomsk. On the Kirgis Steppe, in the provinces of Semiplatinsk and Akmolinsk, about 1,000,000 poods are annually worked, chiefly at Karagandinsk. In Turkestan, coal is worked in the Kara-Tau mountains. In the province of Kuldja there are coal-mines worked by the Chinese with an output of 500,000 poods yearly. In Eastern Siberia, in the Island of Saghalien, a little coal is worked for the use of the fleet. In the province of Primorskaia, on the Gulf of Possiet, and on the Amoor, near the mouth of the Souyfoun, the small amount of coal worked is for the use of the Siberian fleet. Coal was imported in 1880 to the extent of 83,500,000 poods from Great Britain, 21,500,000 poods from Germany, and 8,000,000 poods from Austria, besides smaller quantities from other countries. The iron industry is especially developed in the Ural mountains, chiefly in the Provinces of Perm, Orenburg, Oufa, Viatka, and Kazan. In the Ural, the principal mines are those of Blagodat, Wyssokaia, and Magnitnaia. The mines of Blagodat contain from 52 to 58 per cent of iron, and about 57 per cent of cast iron is obtained; that of Wyssokaïa from 60 to 69 per cent of iron, and about 64 to 66 per cent of cast iron. The mines of Magnitnaia are the richest, containing 66 per cent, and above, of pure iron; but they are situated in a country devoid of fuel. According to official returns, in 1879, it was estimated that there were 1,926 beds of iron ore, 772 of which were worked, and produced 37,000,000 poods of mineral. Wyssokaia-Gora had the greatest output, namely, 5,000,000 poods; and then Gora Blagodat with about 2,500,000; then follow the works of Kyshtym, Alapaieff, Kolounitsk, Slatavust, and Sytersk, which furnish about 2,000,000 poods each. Throughout the whole of Russia, in 1880, 27,000,000 poods of cast iron were manufactured, of which 16,000,000 poods were made in the Ural. Of the total quantity of cast iron made in Russia, in 1880, 25,500,000 poods were made by using wood as fuel, and 1,500,000 poods with coal. The province of Perm heads the list as to the quantity of cast iron made, with 1,400,000 poods, then comes the province of Oufa with 2,000,000 poods, then Radoum in Poland with 1,500,000 poods. In 1880, 10,000,000 poods of steel were made, of which 2,000,000 in the Ural. It is a fact that the places where most steel is made are not those which produce the most iron. Thus the St. Petersburg Government in 1879 produced 7,000,000 poods of steel, and that of Orel in Central Russia 3,500,000 poods, then follow the two Polish Provinces of Warsaw and Piotrkoff, where 4,500,000 poods were made. The Province of Perm comes in as fifth, with hardly 1,500,000 poods.—*Journal of the Society of Arts.*

SERICULTURE.

TURKISH SILK FARMING.

A LATE number of the *British Trade Journal* contains an article entitled, "A Glance at a Turkish Industry," from which the following particulars are extracted:—Mr. Griffitt has for many years been more or less engaged in the double task of combating the various diseases to which the silkworm is liable, and in trying to teach the peasantry how to regain something of the remunerative silk harvests which preceded the unfortunate year 1857. The loss suffered by Turkey when the various silkworm maladies first spread so violently is, he says, incalculable. He remembers the time when the wife of every gardener in the vicinity of Smyrna obtained from her crop of cocoons a sufficient return to enable her to pay for the clothing of her family for the whole year. In those days there were in the neighbourhood of Smyrna three large steam silk-reeling factories, where hundreds of women were employed, but when disease became general this industry had to be abandoned from lack of cocoons. *Flacherie* and *Pebrine* swept away the valuable indigenous races; large areas of mulberry trees were uprooted as being no longer required, and silk-farming came to be almost entirely relinquished. It is true that attempts were made to stem the tide of misfortune by the introduction of foreign eggs, but the peasantry, accustomed to handle their own large and beautiful cocoons, numbering 250 to the pound weight, became disheartened when they had to deal with the far inferior Japanese product of only half the size and weight. About this juncture Mr. Griffitt obtained possession of a quantity of native grain, representing a peculiarly fine race of silkworms, but which were very much diseased. Being aware, from experi-

ence, that no batch of eggs is ever entirely contaminated by disease, and being a firm believer in the system of regeneration by isolation introduced some time before by the French physicist, M. Pasteur, Mr. Griffitt carried it into practice, hatching his worms in separate cells, and jealously following with the microscope every subsequent stage of their development. With an expenditure of infinite patience and trouble, he at length succeeded in rearing his present entirely healthy and vigorous brood, the eggs from which yield about 150 lbs. of cocoons for every ounce hatched; 12lbs. of the cocoons, as taken fresh from the bushes, yielding 1 lb. of silk of the finest quality. Having thus accomplished his first and principal self-imposed task, Mr. Griffitt set himself with equal ardour and determination to grapple with the second. It was not enough to be able to show the peasantry of Bournabat, near Smyrna, where his chief magnaneries are situated, of Nymphio, and of the island of Mitylene that he had mastered the dreaded *Pebrine* and *Flacherie*; but determined to leave no opening for misunderstanding or carelessness, he went among the people personally, with supplies of healthy eggs. In this manner he taught the farmers and peasantry the precautions they should observe, and secured their self-interested co-operation by making them partners in the season's venture. Even then he was occasionally baffled to some extent by the appearance of diseased moths bred from absolutely healthy *graine*, the result of infection caught from diseased worms still in the neighbourhood. Frustrated for the moment only, he still persevered, and now, after years of unremitting struggles with the enemy, he has restored to that district of Turkey some of the prosperity in silk-raising which it enjoyed thirty years ago. During the past season Mr. Griffitt has scarcely lost a single worm through disease, and his peasant friends have been almost equally fortunate, although, others in the same localities, using French eggs, but without the advantage of a paternal director, have again lost heavily through the ravages of *Pebrine*. Accordingly, the most convincing proof that could be offered of the happy effect of Mr. Griffitt's labours among the Turkish peasantry in the places alluded to appears in the following specimen cases of this year—a few instances out of many where educations of silkworms on the Pasteur cellular system have been attained without loss from eggs previously passed under the microscope:—Elleni raised 247½ lbs. of cocoons, which sold for 1s. 2d per lb., £14 8s. 9d.; she expended for mulberry leaves and a girl's help, £2 7s.; leaving a net profit of £12 1s. 9d. This peasant woman attended to the worms without aid during the first three ages, and was assisted by a girl throughout the last two. Adriana's crop consisted of 151¼ lbs. of cocoons, from which she reeled 15 lbs. of raw silk, selling the same at 15s. per lb., £11-5s.; the cost of reeling, &c., was £1-2s., leaving a net profit of £10-3s. Possessing her own mulberry bushes, and having two young daughters, who assisted her during the last age, her outlay was small. Dhopinon and Costoula had a crop of 418 lbs. of cocoons, which produced 44 lbs. of raw silk, and sold at 15s. per lb., £33; the cost of reeling, &c., was £3-5s.; leaving a net profit of £29-15s. These two sisters were also the owners of a small mulberry garden, and were assisted during the last age by two daughters and a son. "Here," as Mr. Griffitt points out, "are poor Turkish peasant women who have acquired, by a few days' labour, what would have taken their husbands three months to earn."

TEA.

THROUGH THE TEA DISTRICTS OF NORTH INDIA.

I.

Darjeeling.

The lay of land in the Darjeeling hill-district, and the style of plant and of cultivation, is utterly different to that of Assam, and affords a more valuable basis for comparison with the Ceylon hill country. The soil at the top of the hills is mostly a very stiff clay, similar in appearance to much that we have in some parts of Ceylon, and exceedingly rich and fertile. Lower down, towards the valleys, the soil becomes quite different and consists generally of a rich black micaceous loam which is very free and porous. So stiff is the soil in parts near the ridges that it is almost impossible to walk along the roads without frequent falls, and ponies travel best if rough-shod.

Generally speaking, the estates are as steep as any planted land we have in Ceylon, but the style of cultivation is different to ours. In most cases, the hill-side at the commencement is formed into small level terraces, and a row of plants put along each; frequently, however, the land is lined in the usual way, up and down hill, is not drained, and yet the wash is trifling in the most heavy showers. The secret in this case is the tenacity of the soil, and the fact that hoeing is only done once or twice early in the season, to open it up, and that, after that, the weeds are only kept down by being cut with sickles.

On terraced land, hoeing can be done more freely, but even here the weeds are generally cut and not dug over the faces of the terraces being carefully treated. Our system of draining does not appear to have been tried. It would, I think, be a success in stiff land, but in many places there is no tenacious subsoil to cut down into, and slips would be the only result of any attempt at draining. Tea is, however, generally opened on land which has been previously cultivated and abandoned by natives, and is consequently full of weed seed. To attempt to eradicate the weeds during their rapid growth in the rains would be most expensive, if not impracticable, and hence wash is to a great extent prevented by the thick matting of weeds which cover the ground and hold the soil together. In consequence of this system of cultivation, the appearance of the estates is not pleasing to the eye, the bushes being in many cases almost hidden by the growth of jungle. Strange to say, in spite of the numerous zigzag roads that have to be cut to open up the gardens, a road tracer is unknown in the district, and consequently, the gradients are very uneven and the roads generally steep and bad.

The buildings here are of a very different character to those in Assam, being *pucka* as a rule, and more like what we are accustomed to in Ceylon. There is a great dearth of machinery in the district, many large gardens having rolling machines only, and are still firing over stoves. Labour is very cheap, and where a manager is popular with his coolies, very plentiful. The labourers are all hillmen, Nepaulese, Lepchas (the inhabitants of British Sikkim), and Bhooteas. They are all under sirdars who receive their pay for them, and are recruited without any expense to the garden, small advances recoverable from the coolies' pay being alone given. The rate of pay varies from Rs. 3 to Rs. 5 a month, and hence Darjiling has the great advantage of plentiful and cheap labour.

There is one drawback, however. It is the custom in many localities to give up a large portion of the waste land belonging to the estate to the coolies for the cultivation of Indian corn. In some valleys hundreds of acres of fine land are seen cultivated in this way, and the loss to the gardens is not apparent in any system of accounts, but none the less real and serious, must be very great. At the present time land fit for tea cannot be obtained in the neighbourhood of Darjeeling by any means, and hence the waste of good soil in the way just mentioned is the more deplorable.

Continuous crops of native produce are taken off the same soil by the coolies in hundreds of acres of land without the payment of any rent or the application of any manure; and the loss by exhaustion, wash, and introduction of weeds must be enormous. Not only this, but in a good (grain) year, the manager has frequently great difficulty in inducing his well-fed coolies to work at all, for they have no inducement to. As regards transport, the district is well served by the railway to its centre, though there are general complaints of delay in the transport of goods, which is excusable in view of the difficulties under which the line has been worked of late.

The hill labourers are very well accustomed to carry very heavy loads uphill, and it is wonderful to see the weight they can take up to the station. A maund-chest, weighing perhaps 130 lbs. gross, is nothing to them, and I saw one man carrying a chest and-a-half, which cannot have been less than 170 or 180 lb.

The method of carrying is that which is, I believe, common to all hillmen—a strap is passed round the bottom of the load and over the forehead, which, with the back, supports the entire weight. The weight is thus distributed over the whole of the upper part of the body in a way which enables enormous loads to be carried up steep hills, which could not be taken for any distance on the flat by the method in vogue amongst Tamils. In appearance, as in character, the Lepchas, Nepaulese and Bhooteas are very different to the Bengalis. When well treated, they are a most cheerful, willing race, and make capital garden coolies. There is no labour law affecting them in Darjeeling, and the vexatious returns and espionage which prevail in Assam are here unknown. With no agreement, the coolies, if mismanaged, are given to leaving in a body, without any notice; but this is a very rare occurrence, their extensive plantations of Indian corn and other grain acting as a powerful inducement to them to settle in one spot. The British frontier being so very close, it says much for their honesty that cases of robbery and bolting are rare in the extreme, although it is the usual thing to send a few coolies and a sirdar alone to the station for cash, which they might easily make off with, if so inclined, with very small risk to themselves. The type of countenance of the Lepchas and Bhooteas is decidedly Mongolian. The men are very ugly, though many of them have pleasing faces; a few of the women are nice-looking, but they are the exception. The latter have a custom of wearing their savings in rupees strung together and fastened round the neck which would appear to offer opportunities for robbery, though such rarely if ever occurs. The Nepaulese are by far the handsomest race of the three. They come from independent territory to the gardens, and take full advantage of the concessions which Government make to native settlers here as elsewhere.

Both in Assam and in Darjeeling the use of "cooty sacks" for plucking leaf is unknown. In the former district, the leaf is collected in baskets slung to the waist, and is weighed in twice a day in the latter: the baskets are supported on the back by forehead straps, and the leaf thrown into them over the shoulder, weighing-

in being generally done once a day only. Baskets are, undoubtedly, very awkward things to carry, especially among closely planted tea, and, when due care is exercised, that the leaf is not pressed down and allowed to heat in any way, the employment of bags is, I think, best, especially with coolies who are acustomed to pick coffee "cherry" in this way. As we all know, sour tea is the result when leaf is allowed to heat in the field, and, in using bags for its collection, the greatest care must be exercised that this does not occur and the *pressing down* of leaf be prevented.

There is one small matter in which Darjeeling is ahead of us and of Assam, and from which we might well take a lesson. The road to every garden is indicated where it leaves the main road by a sign-post giving the name of the estate. The great convenience of this system and the saving of the vexatious loss of time which sometimes occurs through losing one's way should be tried to be be appreciated. A stranger travelling from the station has only to be put on the right road to start with, and he can scarcely fail to find his way with ease and without the loss of time, which "a cooly to show the road" means.

The coolies' lines are invariably situated high up in the hill-side, and never by any chance near the bottom of ravines. In spite of the elevation, it appears that fever hangs about persistently whenever there is the bed of a stream, and stagnant air. The same cause makes it desirable to have the factory in the hill-side, otherwise the distance between it and the bungalow and lines would be a great drawback. The difficulty and expense of choosing and clearing sites for buildings, with which we are familiar in some parts of Ceylon, is therefore reproduced in Darjeeling; but the most serious difficulty is that the supply of water-power can seldom be taken advantage of from the distance at which it is situated. The streams here have very little water in them during the dry season, at which time they are not required; our chief difficulty in Ceylon is that the dry season is the time when water-power is most necessary, and the minimum amount available during the dry months has to form the basis of our calculation in erecting tea machinery. The small extent to which water is used as a motive power in a hilly district like Darjeeling is indeed striking. In some cases, turbines are being used successfully, and there are a few water-wheels, but steam engines alone are employed in the large majority of factories. At one garden, I saw the most perfect piece of motive machinery I have seen in India: a very fine 30-feet water-wheel, perfectly erected, with no very large head of water, was employed driving the several rolling, sifting, and firing machines of a large factory, and it did so with perfect ease at a trifling cost compared with that of working the engine previously used. In another garden where a turbine was employed great difficulty was caused in the entrance into the machine during rainy weather of sand and grit, too small to be collected in the boxes. The most ingenious transmission of power is at a garden in the neighbourhood where a turbine at the river drives machinery in a factory some distance up the hill by a succession of driving belts and pulleys. There must be great loss of power by this system, and the wear and tear of belting would be considerable. As I have mentioned above, the factories are all permanent solid structures, and the limited area of the sites necessitates the utilization of all space inside them. Withering space is generally provided in an upper floor, and hastened by the heat from the stoves and firing machines below, where all machinery, &c., are situated. The remark about untidiness and want of cleanliness which, applied to Assam factories, would be out of place here, the Darjeeling buildings being, as a rule, kept clean and tidy, though not, I think, to the same exten as is frequently seen in Ceylon.

II.

Kurseong.

THE tea gardens in the Darjeeling Terai, have not fulfilled the high expectations which were formed of them at their outset. With perfect lay of land, flat as in Assam, and possessing all the advantages of unexhausted soil and a very forcing climate, they are disappointing in appearance and in result. The reason of this is very apparent. The land consists mostly of a rich surface soil, varying greatly in depth, but seldom approaching that of Assam, and below it lies a sub-soil of barren gravel and sand, excellent for drainage purposes, but ill-adapted for the support of a vigorous deep-feeding plant like tea.

During the early years of growth, the Terai gardens gave most satisfactory results, but when the plant is in full bearing, the yield in many cases falls off greatly, and the vigour of the bushes decreases.

The Dooars, a young and rising district to the east of the Darjeeling Terai, but similarly situated at the foot of the hills has a better soil and gives greater promise of success. The unhealthiness of these districts is proverbial, and has been against them from the first. On one garden I was at, 100 coolies had died quite recently from cholera and 200 had bolted in consequence, leaving an available force of 400 out of an original total of 700. Several instances have occurred quite recently of every soul leaving the gardens for a time, including managers and assistants—for their presence without coolies was of little use—in consequence of the numerous deaths from cholera. Fever is too common a complaint there to call for remark, and new-comers inevitably suffer from it in a greater or less degree for some time. Europeans after a time appear to become hardened and accustomed to it, and throw off attacks after but a temporary period of suffering; but the constitution must become undermined in time by these attacks, and it is a significant fact that in the Terai, in parts of Cachar too, I believe, and in many other localities, managers above 30 or 35 years of age are a small minority. It is needless to point out the many ways in which this state of affairs affects the cost of production of tea. Apart from the risk of loss of labour during crop time—for the unhealthiest months coincide with the busiest crop season—the inducements to manager and assistants have to be made commensurate with the risks to life and health. In a copy of the *Observer*, which I came across by chance up here, mention was made of the fact that three planters had been engaged by a Calcutta firm for a term of years to work in tea gardens, the salaries were stated, and I think a remark was made that they appeared liberal, and that the gentlemen in question were fortunate in being offered them. I cannot but think that this remark was made without due weight being given to the conditions of life in an Indian up-country district. It must be remembered, first, that in the plains water is, as a rule, undrinkable even after the most careful filtering, whilst the cost of aerated waters—an absolute necessity—is very great when they have to be transported from Calcutta, as is usually the case. Servants, too, are a great tax on an assistant's income; "boys' to do the cooking and all the other work of a small bungalow are unknown and several servants must be kept, whose salaries, though individually not higher than what is generally paid in Ceylon, amount in the aggregate to a large sum. Fairly generous living and good cooking are essential to the preservation of health in a trying climate, and how impossible it is for these conditions to be fulfilled on the salaries mentioned I now know well. European managers and assistants are very highly paid on Indian tea gardens, and they thoroughly deserve the remuneration they receive. A young man from home on first joining gets, of course, a small salary of Rs. 150 a month and several allowances generally, and has to manage as he can on it; but good experienced men in charge of good gardens get from Rs. 500 to Rs. 700 a month and a commission on the profits, which sometimes ranges as high as 10 per cent in addition; in the smaller gardens Rs.350 and Rs.400 and commission are very generally given on the plains. The reason of this is that in order to live in such a way as to have a fair prospect of preserving his health a man must have an income of this kind, and must spend a considerable proportion of it. I cannot therefore agree that the sums offered the gentlemen in question, considering that they had experience of estate management and were accustomed to cooly labour, were specially liberal, and this opinion was endorsed by several Indian planters who had heard of the engagements. There are, of course, some parts of the plains more healthy than others, and it is to be hoped that they have been fortunate in the locality to which they were sent.

As is very generally known, most of the Darjeeling hill gardens, and some portion of those in the Terai, are planted with China tea. In Assam, on the other hand, a few gardens have China on them, but they are the exception. The opinion mentioned in a previous letter as having been given by a leading Calcutta tea-taster that a malty flavoured tea was only to be made from high-class indigenous plant, I have found to be quite erroneous. There is no question that at high elevations very choice flavoury teas are made from China leaf, many of them fetching the highest prices in the market; and in some situations, where the cold is great, hybrid plants do not yield in the same way as the hardy China bush. Extreme altitude apart, hybrid bushes are found to yield much more heavily in the hills than China, and the fact that the latter was so very extensively planted in the old days of tea-planting is very generally regarded as a misfortune. In appearance the tea from a China bush is, of course, far superior to any other. The proportion of pekoe is very large, and there is not much coarse uneven leaf. The *liquor* has a very fine flavour, but not much strength. In some cases I was able to sample teas from China and hybrid bushes, grown on the same estate, and the latter was invariably the better tea of the two. The very high and cold portions of gardens apart, all new clearings are being planted with a good hardy hybrid.

The opinions expressed by planters as to the cause of the peculiar *malty* flavour, so much valued by brokers, possessed by some teas are varied and contradictory. In Calcutta, high-class plant and fine soil were given as the conditions, but many such teas have not got it, whilst in one case a tea from the rankest China had it in a marked degree. Another cause assigned was high-firing, but teas dried in a Gibbs and Barry's drier at a temperature of 700 had not got it. Blighted leaf, the stunted shoots from bushes suffering from "green fly" especially, was said to give a malty liquor by another, but I think this is questionable. A fourth planter of experience stated that by manipulation he could always produce teas of this character; a reference to the public sales of tea from his garden was conclusive proof against this statement. An instance was given me of a garden in the Terai, which for a few years, when young, produced fine malty teas fetching a high price, but afterwards they entirely lost this characteristic, and it seems most probable that some quality in the soil is the chief cause. There is an immense amount to be learned yet about tea manufacture, and this point is one which is not as yet understood.

In Assam and the Terai, in all low-lying districts in fact, the success of gardens is known to depend entirely on the class of plant put out. In the early days of planting anything was considered good enough, but now the very greatest care is taken in selecting seed, and the highest prices are paid for it. In the low country, seed from cultivated indigenous Assam trees is the best kind to plant. Seed from the original jungle trees is very delicate, and not so suitable for cultivation as the second generation. The lowest price at which such seed can be obtained is Rs. 150 (one hundred and fifty rupees) per maund, and much has been sold at Rs. 200. It is all bought locally, and in opening gardens in Assam and Cachar the first consideration is "how much seed can be afforded?" *Then* the acreage to be cleared is decided on.

There are two principal sources from which seed is obtained, the Towkok and Singloo indigenous gardens, but all is booked for a long time to come *locally* at such prices as I have quoted. From

gardens which have not made a reputation as seed-producers, the very lowest figure at which high-class indigenous seed can be obtained is Rs. 120, and when a man shows you a nursery in which such seed is shown he does so apologetically, seed worth Rs. 150 per maund locally being the recognised kind suitable for the plains. In sampling teas from the ordinary hybrid and indigenous plant, the difference was as marked as that between China and hybrid in the hills, the indigenous giving a much stronger and more rasping liquor than the other. In yield, the advantage is even greater (in one garden the China gave two maunds, the hybrid 8 maunds per acre), and one of the finest sights I saw was a five-year old garden from Singloo seed with a heavy flush on it. When talking about seed to men in Assam, remarks were often made regarding the planting of cheap inferior seed sent to Ceylon, and cases were mentioned of seed picked anyhow from low class bushes to supply orders for seed at absurdly low rates. Plenty of good seed has gone to Ceylon of course, where fair prices have been paid, but, with the large extensions in tea now going on in India itself, Ceylon men cannot expect to get good seed for an inadequate price. Noacacherry, the place from which Rookwood, New Forest, and some other places in Ceylon got their seed, is known as one of the best sources for hybrid seed of a high-class in Assam.

Indigenous Assam seed, though undoubtedly the right plant for the Ceylon low-country, is by no means suited for planting on the hills; a vigorous dark-leaved hybrid is much better, and such seed is more easily procurable, and at much lower rates. Almost all gardens in Assam are more or less mixed, a certain proportion of low-class plants being found everywhere, and in order to ensure that the manager or assistant shall personally overlook the seed-pickers and make them take it only from the good trees (a course followed in all gardens which go in for selling seed), a fair price must be paid. It is very evident, in fact, that good seed grown locally has in many cases been sold below its true market value as ruled by what such seed would fetch in India itself.—*Ceylon Observer.*

MR. ARMSTRONG ON TEA.

At a meeting of the Dkoya Planters Association, Mr. Armstrong read the following paper:—I have to thank you for inviting me to attend to-day, and am glad to give you my experience of the cultivation of tea in Ceylon, and I trust that the facts and figures, I shall have the pleasure to lay before you, will imbue not only yourselves in this district, but all of us, who have hitherto doubted —and we are now very few—with courage, to turn any unremunerative coffee fields we may possess into paying fields of tea, and in thus doing, I would still advise good bearing patches, which are to be found in every estate, to be kept as coffee, even if only aggregating 50 acres. 200 acres of tea will allow of this being kept in a high state of cultivation, without any increase in the labor force, as there are oftentimes when one is glad to have some other product that would employ one's labour, or a portion of it, for a few days, to the advantage of the tea. And the return from small patches of coffee worked in this way, are almost nett profit; or on the other hand, 5 acres even of tea may be worked to advantage with coffee. Do not let us, therefore, run into the other extreme, but let us keep all the coffee we can, where elevation and soil are suitable, and cultivate it highly with the aid tea will give us. Let our endeavour be to have as many products as our situation or elevation will allow us to grow. Bad fields of coffee we may have, but bad coffee estates, as a whole, I deny. As, at a meeting like this, time will not permit me to enter thoroughly into every detail connected with tea, I have endeavoured to curtail my remarks as much as possible. The more so, as your knowledge of coffee-planting will fill up any gaps. I consider our knowledge of coffee cultivation goes very far to aid us in that of tea, and, with our trained labor, most apt at picking up anything new, to aid us, we can place our tea in the market cheaper than any other tea-producing country in the world.

My remarks to-day have more especial reference to the cultivation of tea in what may be termed our coffee zone, in fact, to the practicability of tea taking the place, in some instances, of coffee, or of its being planted in forest land adjoining our coffee estates, and which we have thought too high for coffee.

Throughout this paper I refer to Assam-Hybrid tea only.

At what elevations will tea grow at in Ceylon to pay? From almost sea level to over 6,000 feet, provided soil and aspect are suitable.

SOIL.—Should be fairly good—the richer the better—deep and friable loam well mixed with sand; a shallow quartzy soil is not good. Tea will not flush readily in this, although it may grow to a fair-sized bush. A subsoil, well mixed with sand, or grit without allowing a very good surface soil, will, although giving a slower growth at first, turn out a better paying soil, than one with a rich surface and clearly defined clayey subsoil without an admixture of sand; the more we pluck, the deeper the roots must go, and we must have room for them. The higher our elevation, the richer should our soil be, to make up for climate.

CLIMATE.—That that is best for coffee, will, I believe, *for a permanency*, be bound to be the best for tea. The beau ideal of a tea climate is Avisawella, Yatiyantota, and the lower portions of Morawakorale, also portions of Ambagamuwa; but they have not our coffee zone subsoil, as a whole; and our zone will, I think, make up, in its deeper soil, for the want of extreme heat, with moisture, which prevails in these districts, where, however, tea will rapidly make a fortune for its lucky proprietors.

The higher the elevation, the less rainfall is required, and *vice versa*; light showers alternating with sun, if we could order them so, would give us 1,000 lbs. an acre at 5,000 feet elevation. At the higher elevations, continued rain at the height of the monsoon has the same effect in checking the flush, for the time being, as a long continuance of sun has in the low country. Perhaps a good thing; for, with us, the bush has no wintering, and the only rest that of a 10 lb pucking, instead of a 24 lb.

SITE AND LAY OF LAND.—Gently undulating land, for choice, is the best; but I have tea on steep land, doing as well as that on fairly flat undulating land. In fact, any land that is most suitable for coffee is most suitable for tea. In our new districts especially, we find our fields at the higher elevations making wood freely; but even at the best of times not giving much fruit, where we have coffee making most wood, there will our tea do best. In my experience I have had poor thin coffee pointed out to me as being suitable *only for tea*. I say no; if we are to expect tea to pay, we must not pick out our thinnest, weakest,—because washed coffee as being the most suitable site, but our free-growing leafy coffee, that from either a bad aspect with good soil (and we often see this), or from too high an elevation, has always persistently run to wood which we call leaf, in tea; with such coffee there need be no hesitation in at once planting it up with tea. Again, we have coffee that in the good old days has borne heavily, but that has now ceased to bear (temporarily or not, is beyond human ken) if we except occasional patches. *If the soil has not suffered from wash*, no matter what the coffee may have borne in the past, tea can take its place and flourish, as it has that in the soil to give it a start, and it can seek for nourishment far deeper than the coffee has ever reached. To sum up on this most important point, do not let us waste time and money on a coffee estate trying to grow tea, where we have found coffee will not make wood, though we may do so where our coffee, although now bad, has been good, in point of crop, provided the soil has not suffered from wash. Ridges and washed faces will be more profitably planted with aloes, which we may grow with other products with profit, or mana-grass to keep out the weeds, than with tea. These remarks do not apply to lower Ambegamuwa, Yakdessa, &c., where tea is *flourishing*, but where coffee could not exist, but to our true coffee districts.

Land at 4,000 feet to 5,500 feet that has failed in cinchona, provided soil and climate are suitable, will grow good tea. I have now tea 3½ years old on land that I planted up four times with cinchona (both officinalis and succirubra),—and that failed completely, although no expense was spared in the opening and planting of it,—doing as well as could be wished. Again, I have tea doing well on abandoned coffee land that was cleared and planted 7½ years ago with cinchona—which died out at 3 to 4 years. Elevation, in both instances, 5,000 feet and over. I have tea also doing well in land that was under cinchona for ten years.

Although tea does well, remarkably well, up to 5,000 feet in my own experience—and I have had figures shown me—proving that tea, at over 6,200 feet gave, at 4×4,400 lbs. per acre, at 6 years old, it does not follow that all and any land, at these elevations, will give the same results. The higher we go the better our soil must be. We must be rather dry than wet, not absolutely without rain for any length of time; but this we need not fear near our mountain tops; and the more shelter from the monsoon winds do we require. I will treat further down of the yield per acre from tea at the lowest to the highest elevations, and will now enter on *seed, nurseries, opening and planting of tea, its cultivation, and manufacture.*

SEED.—The greatest care must be taken to ascertain the seed you obtain is from the highest class hybrid, as with a poor *jat*, neither care in the manufacture nor cultivation can make a good liquoring tea, or give a profitable yield. Making allowances for poor plants, accidents, bad plants, and the having ample plants over for supplies, I calculate on one maund of 82 lb. for 6 acres planted 4×4, a maund of locally grown gives from 27,000 to 33,000 seed, according to the time that is allowed to elapse in weighing after husking; the sooner the seed is in the ground after gathering the better.

NURSERIES.—Choose the site as near a stream as possible, for the sake of water. Let the land be as flat as possible, make your beds 5 feet × 20 feet with 18-inch walks (which act as drains) between them. If you are going to plant out at six months from seed, sow your seed 2 inch apart every way. I find a very useful little tool for this is one I made many years ago for pricking out cinchona—a flat board, with handle on the top and pegs—50—underneath, any required distance apart, press the board, the pegs being underneath, on to your prepared bed, and you have it marked out in fifties to the distances apart, you wish to sow your seed. If you are going to plant them out at 1 to 2 years, 4in. by 2in., or, if space will admit, 4in. by 4in. apart sow 1½ inches deep, if no shade. If your plants are to be forced to save a season, manure your beds, sow in 2 by 2in. apart and 1in. deep, shade with flat tats of jungle stuff 18in. to 2ft. above the bed, and water freely twice a day. You may begin to remove the shade by degrees, as soon as the wood at the collar of the plant hardens. Unless it is necessary for you to save the season, do *not* manure, nor pick out too good soil, as plants grown in better soil, than it is intended to plant them out in, suffer a check from their first start in the clearing. Give your nurseries time; do not dig your beds more than 6in. to 9in. deep, or the tap root, always unmanageable, will run deeper than ever. Every tea garden must keep up a nursery for supplies, which is a work we have to attend to every year. Stumps are best for supplies, and should be at the least two years old even up to four; a permanent nursery can be kept up in *poor* soil sown 3in. by 3in., and the strongest plants taken out for supplies.

LINING.—In fairly good soil, 4 feet by 4 feet is the best distance, in poorer soil 4 feet by 3 feet, on weak soil or exposed faces, 3 feet by 3 feet. It is as well to have 4 feet between the lines, as each line is almost a thoroughfare, from the number of times the pluckers have to move along it, as well as weeding contractors, in the course of the year, and the proper growth of the laterals is in a great measure stopped, if the pluckers have to *force* their way through too much; and in any ordinary fair soil, at a nearer distance than 4 feet between the lines, no light or air can get at the soil or through the bushes themselves, and they become towards the middle of the season an entangled mass of unhealthy wood. Therefore, although 4 by 4 does not suit the coffee lines in any way, if the tea is to be planted through it to eventually the extraction of the coffee (when tea is one year old), it is better to spend a little more money in lining, than to try and suit your lining to your coffee lined, presumably 6 feet by 6 feet.

HOLING.—If for plants at 6 months or 1 year from seed in coffee or in new land 9in. by 9in. will do well. If for stumps in coffee or new land 18in. by 18in. If seed or germinated seed is to be sown at stake, *in coffee*, loosen the soil with the ordinary fork; this is better than holing; as we are all aware, the coffee roots soon find their way into and fill a hole in which the good surface soil has been scraped, to in this case the detriment of the seed: the same holds good with regard to manuring a young seedling which I have heard advocated in coffee.

PLANTS AND PLANTING.—The best plants are those at 6 months from seed, as they do not suffer the same check that a 1-year-old plant does, and equal it in growth at 12 months from planting out; have not such unmanageable tap roots, and stand sun better. Will do with shallower holes, cost less to plant, and have a better hold of the ground at 12 months. The best of all 2 to 4 years old stump-roots of which at this age are woody; will stand being broken; in fact cannot be raised from the nursery (which should be in poor soil) without breaking them. They should be stumped as with coffee at 6 inches, and have roots that will comfortably fit into an 18-inch hole, which they require. In fair soil a stump can be topped at 3 feet in a year, and regularly plucked at 18 months onwards, giving a fine spreading bush.

SEED IN SITU has its advocates. Its advantages are cheapness in sowing out, and the good hold it gets of the ground, an advantage in windy sites. Its disadvantages are, on any *large* scale, greater, first outlay in seed, as from two to three seeds are required at each stake, the liability of its being smothered (as a seed) by wash. Insect enemies, weeders (more especially among coffee), scraping off, unawares, the young shoot as it comes above ground, being trodden on by workers among coffee; many failures, therefore an extra cost in supplying, showing an uneven field; or again three seeds all coming up at one stake and the cost of removing two, but which of course come in useful for supplies. Also a great loss of growth for the first year in coffee by being shaded by it. If you have no insect enemies, notably the black grub, which nips off the young shoot just above the ground, and it is desired to sow in *situ*, germinate the seed first, and then one seed will suffice at each stake, and although great care must be taken in sowing, I have found that even if the root germ is broken or wounded, it throws out a bunch of rootlets and no harm happens.

STAKING.—This is not generally thought necessary. However I consider it *most important*; and wherever we have enough wind to have made it necessary to stake our coffee, it is there necessary to stake our tea, up to 2 years old certainly, and sometimes even up to 3 years of age—a stake driven straight through the middle of the bush without tying will do at 2 to 3 years; at 1 or 1½ years, it must be tied. Aloe taps is best for this.

TOPPING.—First topping should be done at from 15 months on aspects affected by the S.W. winds to 18 months—3 feet is the best height, or at lower elevations or on exposed ridges 2 feet 6 inch to even 2 feet. In topping the coolie has a stick of the desired height which he should place in the middle of the bush; the only care necessary is, to see he does not gather up a bunch of branches in his hand, to cut at one operation, but cuts each singly as it grows; the result will be a perfectly flat surface across the centre of the bush, with many young laterals round the bush untouched, which will soon reach the level to which we have topped; when they and the topped part begin to run up, all should be nipped back to the second leaf below the bud to keep as flat a surface as possible giving, say, at 6 months later, or at 2 years of age, a bush with a fairly flat surface which will have reached 3 feet 6 inch to 4 feet in height. This very slight plucking after topping must be carefully done, only plucking those shoots that show an inclination to climb, so to speak; the plucking, with the topping, is necessary to force the lower laterals up, and keep your bush down and so form *surface*, otherwise, the bush will grow up somewhat in the shape of a poplar, and surface be lost for years. This plucking comes in useful in teaching your labour plucking and manufacture, and will eventually pay its cost in increased diameter of bush, and, therefore, increased yield.

PRUNING.—This is a most important work, and in Ceylon must not be too severe, yearly; more especially if your bushes are topped early. It should take place from June to August, in any part of Ceylon, perhaps July is the best month. There are three ways of pruning:—1st, with a flat surface; 2nd, saucer shape, *i.e.*, hollowing out the centre; and 3rd, hacking down the bush. This last is murder, so I will pass it by without further remark. Saucer shape pruning does well for a time, but inclines to too matted a growth in the centre of the bush, which leads to too heavy a pruning yearly, more costly, and bad eventually for the bush. I have no doubt myself that pruning with a flat surface is best, so I will only treat of this mode.

When our branches *after* topping have reached up to say 3 feet 6 inch to 4 feet, having been kept down to this by plucking at 2 to 2½ years of age, according to whether the planting was done in the N. E. or S. W. (I am referring to tea at from 3,000 feet elevation upwards), they should be again cut to a level surface at 3 feet 3 inches, or if topped lower, as explained above, 3 inches above the topping. Any thin whippy branches trailing on the ground should be cut off close to the stems with a clean cut; and this is all for this year. Next pruning season when our bushes will be 3 to 3½ years old, they should be first topped to 3 feet or 2 feet 6 inches, according to elevation of garden, with a flat surface, all cross wood (*i.e.* branches growing *through* the bush), and all white barked whippy branches, wherever growing, should then be cut off with a clean cut close to the main stem or branch, and all growth encouraged outwards and upwards. No laterals should be cut back, except those growing into the bush which, as I have said, are to be entirely removed, but every branch should be topped or nipped back whether it has reached up to the limit of growth allowed, *viz.*, 3 feet or 2 feet 6 inch, or not, thus we have given our bushes their first real pruning, and have got them into shape, which, with very little pruning they will keep for four years. Our procedure yearly for four years is then as follows always keeping a flat surface:—1st year, our bush being 4 to 4½ years old, top at 3 feet 3 inch; 2nd year, at 3 feet 6 inch; 3rd year, at 3 feet 9 inch; 4th year to between 3 feet 6 inch and 3 feet 9 inch; or if topped at 2 feet 6 inch, rising 3 inch yearly, keeping as much *red* wood as we can and removing *each* year thin white barked whippy branches, and cutting out all crows' feet from the surface, caused by plucking, leaving not more than a single fork on each branch at the surface; 5th year, cut down to 3 feet or 2 feet 6 inch at lower elevations or just below the original cut, and proceed as before. Thus low topping and heavy pruning is best done every 5th year. At our higher elevations, say from 3,500 feet upwards, we can top our bushes far higher than at the lower elevations, and so get increased surface; the flush does not run up from the bush, in the same manner it does lower down, our limit here, however, should be at the outside 3 feet 9 inch.

EXCEPTIONS.—Some bushes sulk, either from over-plucking or from bad wood, or from some other cause. These should have the knife applied freely either by being cut down to 18 inch, or by removing, with the aid of the same, one or two of the main stems in the centre, cutting down the outer growth as well, to 2 feet or 18 inches; the centre thus opened out will send up a new growth. These bushes should not be plucked till they are well up, say, to 4 feet, when they can be plucked and then topped with the knife to 3 feet.

PLUCKING.—This again is a most important work and requires close supervision. As a rule, plucking can be began at 30 to 40 days after light pruning, I am speaking of coffee zone teas, be it remembered—and should not be begun till the bud with opened leaf attached, and half the next leaf, can be plucked at one operation, *leaving on* one or sometimes two fully formed leaves to carry on the young shoot. The shoulder of the half leaf plucked remains on, and protects the eye at its base, which in its turn throws out a shoot. Shoots, according to elevation, will measure 6 inch to 9 inch long *before* the first plucking, after pruning, takes place. In after plucking, a good deal depends on the number of leaves on the shoot. If, with the bud and its partially opened leaf, we have four full leaves, then I should pluck at the second leaf down (leaving on the shoulder of this leaf, which protects its bud, and will probably give red leaf if removed) at one operation, and again half the 3rd leaf at another operation, leaving one fully formed young leaf on the shoot. Towards the end of the season, when the bushes are well up, I would act as above, only plucking at the 3rd leaf, leaving its shoulder on the stem, and thus removing at one operation a half leaf and the shoot consisting of two leaves and the bud. One simple rule in plucking is, to avoid having a bare shoot

without a single leaf to help it on. As in most things, a practical lesson is best in plucking. As for the number of days in which it is necessary to go round the garden, I learn at a low elevation, it is considered necessary, according to the time of year, to get round in 7 to 10, up to 12 days at the longest. At high elevations, I have found in my *best* months, I should get round in 10 to 12 days to keep pace with my flush, and, again, in 15, to, in the very cold weather, December to January, 20 days. I do not think any hard-and-fast rule should be laid down, at any elevation, as to time. It is for the manager to watch his flush, and wait on it, *just* long enough, but no longer, and not to rush violently round his estate in a given number of days, which *must* lead to over-plucking, which means a reduction in yield sooner or later, although perhaps higher prices, for the time being; the benefit of this is also in a way nullified by a smaller outturn.

My average runs this season from, in my worst month, 10 lb. up to 29 lb. of leaf per coolie, including children. Some of my best pluckers have brought in from 36 to 47 lb. : in ordinary months, I average from 20 to 26 lb. My plucking last season 1881-82 cost 5 3-5ths cents per lb. of tea. This season it will cost 6 cents. Leaf should be weighed in twice, daily, at mid-day and at knocking off time; it is best plucked into the ordinary cooty sack, and emptied into cane or bamboo baskets of the following dimensions, to avoid any chance of tight packing :—2 feet high, 18 inches across bottom by 1 foot across top. Cane baskets cost me 62 cents each, bamboo 25 cents to 37 cents, but cane are the cheapest in the long run, and nearer the cane country than I am would probably run from 37 to 50 cents each. Leaf must not be pressed down in either cooty sack or basket. Each basket is best kept by its owner in the line he is working in; the cooty sack should be repeatedly emptied into it, to avoid any risk of fermentation. As soon as weighing-in begins, leaf should be removed without delay to the withering shelves. Both baskets and cooty sacks should be taken in after the last delivery, or the coolie may use them to carry bazaar stuffs which may taint the leaf, and in any case they get smoked in his lines. *Bangy* tips, *i.e.*, a hardening of the bud and stoppage of growth, should always be plucked; if the single leaf of which it consists is soft, it can be utilized, if not, it should be thrown away. It is as well to take the opportunity of any small plucking to rip off all bangy, the next eye will then nearly always throw out a free running shoot.

WITHERING.—The most simple and best shelves for this are formed of a framework of reepers, covered with sacking,—6 feet long and 3 feet 4 inches wide; the reepers forming this should be 2½ inches wide by 1 inch thick; it takes 1½ sacks to cover this, or jute-hessian forms a good cover. It is most convenient to have 12 of these shelves hanging, at 6 inches, one above the other. The reeper forming the front and back of the frame should project 1½ inches; these projections are rounded off, and at the back are let into holes cut in an upright post to fit them; in front the projecting ends serve to hold up the shelves by fitting into knotted loops 6 inches apart in ropes, suspended from the roof. When it is desired to empty them, it is done by simply pulling out the ropes at each end, when the shelves hang flat down on their hinges, throwing their contents on the floor; the upper shelves are reached by the coolies who lay out the leaf to wither, by 3-legged stools 3 feet high. Leaf should be spread as thin as possible and turned over once during withering—a shelf of above dimensions 6 feet × 3 feet 4 inches, holds very thinly spread 2 lb. of leaf, or at a pinch it will wither safely up to 4 lb., but not more. Say we put on 3 lb. in full plucking time, we require about 6 feet per lb. of leaf.

Leaf is properly withered, if, when held tight in the hand it does not crackle and keeps the shape into which you have pressed it; properly withered leaf is best told by touch, which experience gives us after a time. Leaf to give a good make, that is, twist and colour of infusion—copper colour—should be well withered, soft to the touch, not dry or crisp; under-withered leaf will not give a malty liquor, and the larger leaves (souchong) break in rolling, probably lessening the value of your broken pekoe, nor is the make so good as with well-withered-leaf.

ROLLING.—Rather overdo this than under-roll; when leaf is properly rolled, it shows a good even twist, is very soft, and gummy to the touch; any liquor that exudes during the process of rolling should be mopped up by the leaf, now called *roll*. In hand-rolling it saves tip, if, when the rolling is half finished, the leaf is sifted through a No. 4, that which remains in the sieve is rolled separately, that which comes through *lightly* finished off. A man can take 2 lb. of withered leaf to roll at one time, and it takes him 20 minutes to finish it.

FERMENTATION.—After your leaf is sufficiently rolled, break up the roll well, so as to have no lumps in it and place it lightly in saucer-shaped baskets of bamboo, or cane 18 inches wide by 6 inches deep; these again to be placed inside a sack to ferment. Each basket holds about 12 lb. of roll—no actual time can be laid down for fermentation, as it all depends upon the day or time of year. In cold weather at 5,600 feet, I have waited for 6½ hours for it to ferment, although my house has been kept at 90°. Again, at low elevations, I have seen roll properly fermented in 20 minutes from rolling. As far as time is concerned, at high elevations in ordinary weather, I find it takes from 1½ to 3 hours. Machine-rolled ferments quicker than hand, an advantage in favor of machine. Roll is properly fermented when it shows at a *first* glance a bright new copper color. We must not in making this test, examine the roll too carefully as, if we do, we will find almost as many green as copper-colored leaves; the *first* glance on taking up a handful must decide us. As a rule, we should ferment up to our pekoe-souchong and let the rest take care of itself; if in doubt, underferment rather than overferment; overfermentation may cause the tea to be altogether sour, and in any case gives a dark-colored flat liquor, with darr dead-looking infusion.

For the first two or three rounds after pruning, our leaf will not give us a very bright infusion, and there is no use waiting on the fermentation to try and get it; all comes right as the wood matures.

Having arrived at a proper state of fermentation we should hand-roll lightly again, even if machinery is used. Coolies employed in the factory, firing, withering, &c., &c., are sufficient to do this. It is necessary, as it inclines the roll, opened more or less by fermentation, to take its twist again as it is being fired, and it also ensures the whole being thoroughly well separated, before being placed in the firing trays.

IN FIRING.—Over charcoal the bottom of the tray which is covered with 24 to 26 brass mesh should be 21 inches from the fire grate which is again 9 inches above the level of the floor, or, the stoves are from the level of the floor to the top 30 inches high, 3 feet wide, at the top inside measurement, sloping to 1 foot 2 inches at the grate, which rests on ledges 1 inch wide, making below grate to floor level 1 feet wide. It takes 40 minutes to complete the firing of each tray of roll, as thus :—

Each tray 3 feet square inside measurement will hold 5 lb. of roll, which when fired equals about 2 lb. of tea. The tray should be constantly removed from the stove, and the contents well turned (on no account should any turning or fingering be allowed when the tray is over the fire, as dust drops through, burns, and smokes the tea at once) after about 15 minutes drying, being constantly turned the while, the partially fired roll should be sifted through a No. 8 sieve; that, which remains in the sieve is again placed over the stoves, being as before constantly taken off and turned, and in 15 minutes is ready to be again sifted this time through a No. 6. It then takes 10 minutes to finish off, being constantly turned the while. The siftings are left on the table till all teas are finished firing: these represent broken teas, broken pekoe, pekoe No. 2, and dust; and are finished off over the hot stoves by the expiring fires—this takes about 10 minutes. Experience alone can tell us when teas are properly fired, they should feel crisp to the touch, and when bent resume their shape. As each tray is fired off, the tea should be put into a bin, for the purpose, and exposed on the table as little as possible.

TASTING.—The first thing the next morning as sorting begins, the "make" of the previous day or night should be infused and tasted carefully; we then know what to do with it, as we should keep our classes of different values (or grades) separately, and a good break may be spoiled by having one or two days inferior make mixed with it. Accidents sometimes happen also, such as overfermentation, if there is much night work, and this can only be detected by infusing the leaf; burning also. No tea should be packed away therefore (mixed with the bulk) till it is tasted and faults, if any, discovered, to be rectified in the future.

SORTING.—This is best done by women: one woman to every 100 lb. of tea. Red and large flat leaf is first picked out, and the tea is then passed through a No. 7 or 8 sieve, according to the size of leaf, *i.e.*, tea of any particular day, that which comes through is next put into a No. 10 or 12—the *higher* the elevation the smaller and more wiry the make—that that remains in the No. 7 or 8 must be *lightly* broken through by hand; and what still remains in (very little) is congou and black fannings; that broken through is broken tea and broken souchong, which is mixed after removing the dust and broken tea with the pekoe souchong pure, remaining in No. 10 or 12, and the mixture classed as pekoe souchong. We then have left to deal with pekoe, broken pekoe, broken tea and dust, all of which has been passed through a No. 10 or 12—to extract as shown our pekoe souchong. This we *again place* in No. 10 or 12, *lightly* sifting it, to remove broken pekoe, broken tea and dust, leaving the pekoe in the sieve. We then with an ordinary rice winnower ("sholegoo"), remove broken tea and dust from the broken pekoe, the broken pekoe remaining in the winnower; the broken tea and dust we then put into No. 24, passing the dust through. To separate tea dust from pekoe dust, we can use either muslin or the winnower, again. We have now sorted our teas into the following classes :—1. Pekoe. 2. Pekoe souchong. 3. Congou (and fannings with large unrolled leaves). 4. Broken pekoe. 5. Broken tea; tea dust and pekoe dust. I do not count as a make nor yet fannings; the latter may, in most instances, unless the plucking has got ahead of you, be mixed, after breaking, with the broken tea. Faunings we break through a Reid's breaking machine, turning out a reddish make about twice the size of our broken tea, which, if poor in liquor, we ship separately as fannings; or if showing a fair liquor and not too much red leaf, mix with our broken teas. Of congou, fannings, and the dust, we have a very, very small percentage each day. The numbers of sieves we require are as follows :—No. 4 *for sifting green leaf in rolling by hand, to give more "tips."* No. 5 useful sometimes, when plucking has got ahead of you; and Nos. 6, 7, 8, 10, 12 and 24.

PACKING.—As, according to the new rules bulking on the gardens is now accepted in London and our tea saved from being all turned out, provided tares run pretty equal, I recommend each class of tea to be packed as soon as sufficient can be bulked to make 25 half chests of 50 lb. each. These should measure 15 × 16 × 16, and tare, on an average 18 lb. including lead, do not require hooping, and represent one cooly load. As soon as we have packed all our teas to complete that particular break or shipment, (which ought not to be under 5,000 lb. nett I think, and the more the better), we may add our dust, fannings, and congou which will only amount to a half chest or so of each. These teas will run from 5d. per lb. to 10½d., and are as well shipped, if a half chest can be made up with each break from which they have been made. I find a half chest takes 3½ lb. of lead and 1½ oz. of solder—or cost of half

chest with lead-lining, &c., ready packed cents 3·500 per lb. of tea.

Whilst on this subject, I think it would be of great advantage to us all if we could arrange to use one uniform package, and no package can be more convenient for us than the half chest as above —the majority of us have to transport our chests to the main road on cooly's heads—this half chest represents just a full cooly load. Whereas a chest takes two coolies to carry it, has to be hooped—a costly work—and there is all the worry of rope which is constantly stolen, and poles, to carry it; therefore, the saving in draft in London (under ½-a-lb. of tea) and the slight difference in its favor in cost, in the first instance, is more than counter-balanced by the cost of hooping and transport, with the accessories of poles and rope. I trust, therefore, that those interested in tea in Ceylon, will from this year—our first great start almost,—arrange to use one uniform package which shall be peculiar to Ceylon, and become known as the *Ceylon chest.* This for the bulk of our teas, but we may also pack occasional breaks in boxes; these should weigh under 28 lb. gross and thus save draft, say 10 to 15 lb. nett. And especially fine make could be shipped in these, forming a small break, and will often fetch fancy prices. Brokers at home accept both half chests and boxes, so there is no innovation here. A coolie can pack carefully, 15,—shall I call them Ceylon-chests?—in a day.

I now come to yield and cost per lb. f. o. b. at Colombo.

YIELD.—In my own experience, at 4,700 to 5,600 ft. elevation, with fair soil, ordinarily featured land, as our hill country goes, fairly steep, I find the yield has been as follows, and I do not consider I am yet in full bearing:—

At 2½ to 3½ years old 163 lb. tea per acre.		
3½ to 4½ ,,	292 ,, ,, ,,	
4½ to 5½ ,,	262	pruned heavily in July last season,—season ends in Sept.—to shape bushes which explains shortness of yield.
5½ to 6½ ,,	450	

6½ to 7½ ,, finishes end of Sept., 700 lb. per acre will be exceeded all round.

Bushes from the first have been under-plucked.

Again, I have yield given me at an elevation of 1,800 to 2,500 feet.

Average age 3 years	224 lb.	per acre.
4 ,,	380 lb.	,,
5 ,,	315 lb.	,,

And please note, on this garden of over 200 acres in extent, there was a considerable loss of leaf, from allowing large areas to grow up during these three seasons, for seed, from which little if any leaf was plucked, had the full acreage been plucked the average would have reached 100 lb. more per acre.

Again, I have given me figures of an estate, at an average of 2,500 feet elevation, 400 lb. per acre at 3½ to 4½ years old.

Another estate, at an average of 500 feet, gives for the first *six months* of this year, January to June, being in June 4 years old, 400 lb. per acre, the estimate to December is 800 lb. per acre; and will probably be exceeded. Again, an estate from 100 to 400 feet, showing an average age all round of 4 years, gives 430 lb. per acre. This estate is widely planted 5 × 6 and 5 × 5, and had it been 4 × 4 would have given a larger yield, as bushes do *not* cover the ground; but 430 lb. at 4 years is good enough, you will allow.

I have again many instances of estates, up to 3,000 feet, giving 400 to 600 per acre up to 5 years of age; and at 4,000 to 5,000 feet, from 380 to 420 lb. per acre.

We have all heard of Gallebodde and its 800 lbs. odd per acre; also of the older portion of Dunedin with its 730 lb. per acre; a portion of one of my fields 3 acres in extent has given me at 7½ years 1,200 lb. per acre at 5,300 feet elevation, well sheltered with fine soil—an exceptional field, I will allow. These figures are fairly representative of tea in Ceylon at this date, and not *one* of the estates mentioned is in full bearing. What *will* the yield be when we are in full bearing, from 8 years of age upwards? We shall want lots of withering room, gentlemen: so be prepared in time.

Young as we are, and in the face of these yields at 6 years of age and upwards I feel perfectly safe in estimating an *average* yield of 400 lbs. per acre from tea in the coffee zone and above it, say from 2,500 to 5,700 ft. in sheltered situations, and in saying 5,700 ft. I do not wish it to be understood I draw the limit even here, but the figures I have had given me above this elevation, viz., at 6,300 ft., are only from a very small area under tea, which however gave at 6 years old 400lb per acre at 4 by 4. For low-country teas, that is, teas at from 2,500 down to sea level, at 6 years old and upwards, I shall be very much surprised indeed if they do not show an *average* yield of 600 lb per acre. These estimates, gentlemen, may seem excessive, looking at the average yields from Assam and India generally, but compare our yield in this our very infancy with that in India, and you will find we can even now show an average, from estates at 3½ years old up to 6, which will more than double theirs. Inclemency of weather does not affect us in the same way in which it does our Indian fathers, as we have 11 months in which we pluck. If one month is too wet, we benefit all the more when the sun shines again, as we have lots of time if we have a spell of dry weather, on the other hand, this again is sure to be followed by rain, when we at once make up any loss.

Cost per lb, f. o. b.—I have to thank many friends for furnishing me with cost *f. o. b.* at Colombo, and choose the following which are representative of all and may be relied on. In all cases, the tea was manufactured without the aid of machinery of any kind.

450 lb. per acre cost 36 cts. *f. o. b.*		Including cost of upkeep of young tea not in bearing.
700 ,, ,, ,, 30 cts. *f. o. b.*		
400 ,, ,, ,, 40 cts. *f. o. b.*		
430 ,, ,, ,, 29 cts. *f. o. b.*		

If we take the average of the above 4 estates, we have say 495 lb. per acre, hand-made, costing 34 cents *f. o. b.* at Co'mbo; London charges including freight are under 2½*d.*; but for all practical purposes let us say 2½*d.*, the above teas at an average price of 1*s.* 2½*d.*, and this is not a high average, leaves us 1*s.* nett, or at 1*s.* 8*d.* per rupee, 60 cents; a profit of 26 cents per lb. at 495 lb. per acre, say Rs. 128·70 profit per acre.

Whilst I am on the subject of yield I trust we in Ceylon will talk of *lb.* per acre and not *maunds*; our tea is sold by the lb., what then can we have to do with maunds?

With regard to plucking and manufacture, I find its actual cost is as follows without machinery:—

Plucking (including baskets and coolie sacks) ...	cents	7·000
Withering, rolling, fining	,,	6·500
Sorting, refiring, packing (in half-chests), including lead solder and chests	,,	4·000
Total ...	,,	17·500

The rest of the works depend upon circumstances, and in many instances can be done cheaper with regard to some of the items than I now shew. Take, for example, a garden of 150 acres, bearing at 400 lb. per acre.

Supdt. including Factory Overseer, at R20 per acre, cost per lb. of tea	cents	5·000
Weeding at 87 cents per acre, R10·44 per acre per annum ...	,,	2·610
An ordinary pruning at R6 per acre ...	,,	1·500
Nurseries, R225	,,	·375
Supplying at R4·50 per acre	,,	1·125
Roads and drains at R3 per acre	,,	·750
Tools say R150	,,	·250
Transport Tea from estate f.o.b.	,,	2·200
General Transport	,,	·400
House and tappal coolies, medicines, stationery, contingencies, and export duty and medical aid	,,	1·540
Upkeep of buildings at R450 per annum ...	,,	·750
Manuring 30 acres per annum at R100—R3,000	,,	5·000
Total estate expenditure per lb.	,,	21·500
Add cost of plucking and manufacture as above ...	,,	17·500
Total cost 400 lb. per acre f.o.b. at per lb. tea *hand* made	,,	39
Value of 400 lb. tea at 60 cents per lb. *nett* Rs. 240		
Less cost as above at 39 cents per lb		153
Net profit per acre		R84

Or if no manuring is done R104 per acre profit. Manure of course eventually pays for itself by *increased* yield.

I believe the above to be a liberal estimate; it is at all events one higher than I should allow for the working of my own garden, which is in perfect order, R150 per acre for 400 lb tea is liberal enough, without machinery. I will now show my experience of the benefit machinery gives us.—On a coffee estate with *water wheel already erected* a Jackson's universal roller should be purchased, for even only 25 acres of tea, as I think the following figures will prove. I take 400 lb. of tea per diem as my standard as the following machinery works up to it, and this machinery is sufficient for a garden of 150 acres giving up to 500 lb per acre.

One Jackson's Universal Roller fixed ready for working	R.	1,200
One Davidson's Sirocco	,,	1,300
To drive the roller a 16 to 18 feet water-wheel will do, or if no water power a 2½ H P. engine costing say on estate ...	,,	1,500
A second Sirocco is most useful and if means allow of it should be purchased, so I will add it, although not absolutely necessary	,,	1,300
		5,300
Add a sorting machine at a cost of say ...	,,	950
	R.	6,250

If the garden is to be increased in area it is better and cheaper to purchase at the first Jackson's larger roller called the "Excelsior" exactly the same as his "Universal" only working up to 8,000 lb. of leaf per diem, instead of 2,000 lb. and costing at the garden

about Rs. 2,250. This with 4 Siroccos will work up to a 300 acre garden, and requires 5 H.P. to drive it.

Working, however, with our "Universal" at 400 lb. of leaf per diem, costs us as follows:—

Plucking per lb. tea	cent	7·00
Withering, rolling 1,600 lb. leaf = 400 lb. tea at 4 coolies, say	"	·41
Firing ditto at 3 coolies *including* firewood, say	"	·25
Sorting *by hand*, refiring, packing in half chests, including chests, &c. &c. ...	"	3·50
Total cost of plucking, and manufacture by machinery	"	11·16

or a saving per lb. of tea of cents 6·34 as against hand-rolling and charcoal firing. I have not as yet worked a sorting machine, but I believe with two coolies to attend to it (driven by water or steam) a Jackson's or Ansell's will sort into four classes at the rate of 400 lb. per hour. Let us, for example, take 5 coolies per 1,000 lb. including the picking out of red leaf, its cost is exactly half that of hand-sorting or cents 0·165 as against cents 0·33 per lb., or say we have *a saving of 6½ cents per lb. of tea*, with all machinery complete. This at 400 lb per acre yield represents a saving of Rs. 26 per acre or brings up profits as per former estimate to Rs. 100 per acre, or, if no manuring is done, on a young garden, to Rs. 130 per acre. From these figures you can work out the profits at any yield per acre; cost of manufacture is always the same, except when machinery is used, when the nearer we work up to its full power, the cheaper are we able to manufacture our teas, as there is then no loss in coolie labor at machinery; cost of the other works is increased or lessened in proportion as the yield is lower or higher. In further reference to machinery, in making any quantity of tea per diem the machine roller will turn out a better make than can be obtained by hand-rolling. One or two picked coolies might roll better; but when we have from 20 to 80 coolies to attend to, machine-rolled tea will carry off the palm. Sirocco-fired teas, as I have myself tested, are brisker and fuller than charcoal fired teas. I find my Sirocco at 275° will fire off 100lb of roll per hour, equal to about 45 lb. of tea; my "Universal" rolls the equivalent of 200 lb. of green (unwithered) leaf per hour or 150 lb. of withered leaf in 75 minutes, taking in 37 lb. at a fill, which it rolls in 20 minutes, and we have to allow 5 minutes for emptying and refilling. If on a coffee estate you have not sufficient power already erected to drive the "Excelsior" roller (6 H. P.) I can, for *fine* leaf, recommend Kinmond's Centrifugal, one of which rollers I also have. This requires only the same power as the "Universal," but will roll off 4,000 lb. of green leaf per diem, instead of only 2,000; its cost is about Rs. 1,700 on the garden. It will not roll coarse leaf well, so with one of those rollers you must keep up with your flush, its great advantage is its cheapness as compared with the cross action for amount of work it does, with the small power it takes to work it (2½ H. P.) and with good leaf, the large amount of tip it turns out, although, where it can be worked, I prefer the large cross action (Jackson's) "Excelsior." To compare labour required to make 400lb. of tea by hand and charcoal, with the number of coolies required to make the same with the "Universal" and "Sirocco," I find the following:—

By hand-withering 1,600 lb. leaf	2	coolies.
Rolling ditto	40	
Firing and charcoal	16	
Total for 400 lb. tea	58	
By machine-withering 1,600 lb. leaf	2	coolies.
Rolling do.	3	
Firing &c.	3	
Total ...	8	

Saving in labour at 400 lb. of tea 50 coolies. This really represents a saving of 7½ cents per lb., or the roller saves 37 coolies and the "Sirocco" 13 coolies at 400 lb. tea. To aid in working the "Sirocco," I make any laborer not carrying in leaf, carry in a log of firewood every evening, which one coolie can cut up for the "Sirocco."

THE FACTORY—Should be roomy and have as much light as possible. All green leaf, whether withering or being rolled should be shut off from the firing, sorting, packing and store-room, or it collects dust, &c. Even with a "Sirocco," we should be provided with stoves, ready for charcoal firing, in case of accident. Cleanliness must prevail from rafter to floor. Our coffee stores, when too large for our crop, as at present, can be at a small expense turned into a suitable factory, a portion being walled off for our coffee crop.

Land can be opened, not including purchase of course, at the following rates per acre for the first year:—Jungle Rs. 80, patana Rs. 50, and coffee Rs. 40 to Rs. 50. Coffee should be uprooted when tea is at 1 to 1½ years old, unless it has on it sufficient crop to make it worth while leaving it. Tea at three years of age will prevent coffee giving sufficient crop to pay, and will eventually kill it out, so the two cannot be grown side by side. Coffee, when uprooted, may be stacked with advantage for firewood or charcoal. We can grow *among* our tea to advantage, according to elevation taking care not to overcrowd it, C. officinalis (best of all, as it gives no shade to speak of, and thrives better among tea than in the open), small-leafed Robusta and Ledger, the upkeep is *nil*, harvesting being the only expense after planting. We can grow *with* tea to a *large saving of expenditure* in both coffee or cocoa according to elevation. And let us aim, with tea as our mainstay, to grow all the products the elevation of our garden will allow of, with it. *Experientia docet.—Weekly Ceylon Observer.*

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RANEEGUNGE FIRE BRICKS as supplied to Government and the various Railways, Iron Works, Coal, Gas, and Steam Navigation Companies. Price—Rs. 9 per 100.

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"*The Fire Bricks tested by me were furnished by the Firm of Messrs. BURN & Co. * * * The materials from which they are made are very refractory and capable of resisting high temperature without sensibly fusing. * * * That compared with Stourbridge Fire Bricks are somewhat superior.*"

The specimens were subjected to a temperature of over 3,000 degs. Fahr., the smelting point of Cast-iron being 2,786 degs. Fahr.

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ZULULAND AND CETEWAYO.



"'I know what it is,' he answered; 'this honey is made from euphorbia flowers, which are very poisonous.' This explanation made me feel exceedingly uncomfortable; but I elicited from him that there was not much danger, as the 'maass' taken with it would neutralise the effect of the poison. Directly he mentioned poison I dived into the packs, and pulled out a bottle of ENO'S FRUIT SALT, and emptying a quantity into two pannikins, filled them up with water, and several times repeating the dose, in a few hours we were considerably better."—"*Zululand and Cetewayo,*" (*p. 139*), *by Captain W. R. Ludlow, 1st Batt. R.V. Royal Warwickshire Regiment.*

"'What on earth shall I take to Zululand?' asked my friend Jim Law one day at Aldershot, when he had just received orders for South Africa, to start at forty-eight hours' notice. I replied, 'If you take my advice—and it's that of an old traveller—you'll not budge without a few bottles of ENO, even if you leave half your kit behind. I never am without these Salts, and, please the pigs, never intend to be.' On his return I inquired, 'Well, how about ENO'S FRUIT SALT?' 'My dear fellow, it was the best advice you ever gave; they saved me many an illness; and when I left Tuegla, I sold the remaining bottles for ten times the original price!'"—*Lieut.-Col.*

JEOPARDY OF LIFE. THE GREAT DANGER OF DELAY.

You can change the trickling stream, but not the raging torrent.

WHAT EVERYBODY SHOULD READ.—How important it is to every individual to have at hand some simple, effective, and palatable remedy, such as ENO'S FRUIT SALT, to check disease at the outset! For this is the time. With very little trouble you can change the course of the trickling mountain stream, but not the rolling river. It will defy all your tiny efforts. I feel I cannot sufficiently impress this important information upon all Householders, or Ship Captains, or Europeans generally, who are visiting or residing in any hot or foreign climate. Whenever a change is contemplated, likely to disturb the condition of health, let ENO'S FRUIT SALT be your companion; for, under any circumstances, its use is beneficial and never can do harm. When you feel out of sorts, yet unable to say why, frequently without any warning you are suddenly seized with lassitude, disinclination for bodily or mental exertion, loss of appetite, sickness, pain in the forehead, dull aching of back and limbs, coldness of the surface, and often shivering, &c., &c.; then your whole body is out of order, the spirit of danger has been kindled, but you do not know where it may end: it is a real necessity to have a simple remedy at hand that will answer the very best end, with a positive assurance of doing good in every case and in no case any harm. The pilot can so steer and direct as to bring the ship into safety, but he cannot quell the raging storm. The common idea when not feeling well is, "I will wait and see, perhaps I shall be better to-morrow;" whereas, had a supply of ENO'S FRUIT SALT been at hand, and use made of it at the onset, all calamitous results might have been avoided. What dashes to the earth so many hopes, breaks so many sweet alliances, blasts so many auspicious enterprises, as untimely death?

ENO'S FRUIT SALT.—"After suffering for nearly two and a half years from severe headache and disordered stomach, and after trying almost everything and spending much money without finding any benefit, I was recommended by a friend to try ENO'S FRUIT SALT, and before I had finished one bottle I found it doing me a great deal of good, and now I am restored to my usual health; and others I know that have tried it have not enjoyed such good health for years.—Yours most truly, ROBT. HUMPHREYS, Post Office, Barrasford."

THE ART OF CONQUEST IS LOST WITHOUT THE ART OF EATING.—DINNER ENGAGEMENTS.—STIMULANTS.—TOO RICH FOOD.—LATE HOURS.—INSUFFICIENT EXERCISE.—EXCITEMENT, &c.—A gentleman writes: "When I feel out of sorts, I take a dose of ENO'S FRUIT SALT one hour before dinner or first thing in the morning. The effect is all I could wish." How to enjoy good food that would otherwise cause biliousness, headache, or disordered stomach—use ENO'S FRUIT SALT.

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CAUTION.—*Legal rights are protected in every civilised country. Examine each Bottle, and see the capsule is marked* "ENO'S FRUIT SALT." *Without it you have been imposed on by worthless imitations. Sold by all Chemists, price 2s. 9d. and 4s. 6d.*

DIRECTIONS IN SIXTEEN LANGUAGES HOW TO PREVENT DISEASE.

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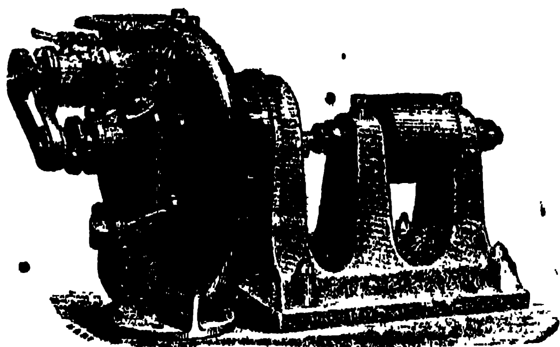
Forged and Cast Iron Work, Boilers, Machinery for Jute, Cotton and Rice Mills, Collieries, Indigo Concerns, Tea Gardens, &c., Contractors' and Brick-making Plant, and every class of Iron and Brass Work made to order.

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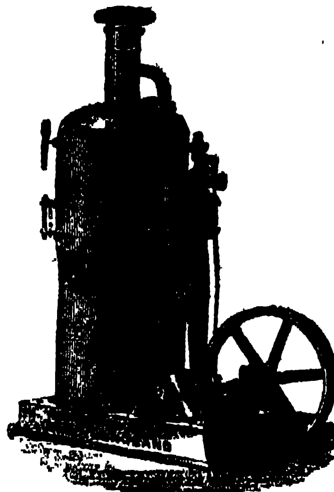
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IMPORTERS AND MANUFACTURERS OF EVERY DESCRIPTION OF STEAM ENGINES AND MACHINERY.

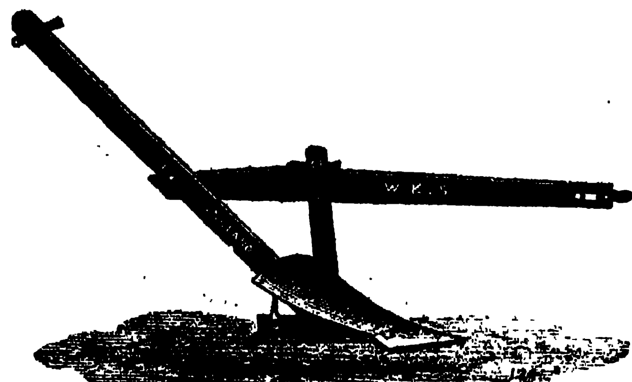
Robey & Co's Portable, Horizontal, Fixed, and Patent "Robey" Semi-fixed Engines, Combined Vertical Engines and Boilers, Land and Marine Boilers, Gould's Rotary Power Pumps, J. & H. Gwynne's "Invincible" Centrifugal Pumps, Hand, Lift and Force Pumps, Tangye's "Special" Steam Pumps, "Vauxhall" Donkey Pumps, Flour Mills, Saw Benches, Spencer's Hand Drilling Machines, Steam Pressure Recorders, Richards' Engine Indicator, Gifford's Injectors, Cooking Stoves, Fire-Proof Safes.



J. & H. Gwynne's "Invincible" Centrifugal Pump.
This Pump being arranged to swivel on the bed-plate may be fixed at any angle required. It does not require a foot-valve, being fitted with small air exhauster and clack on discharge, which always keep it charged ready for work.



Robey's Combined Vertical Engine and Boiler.
This class of Engine is nearly twice as large as those of the same nominal horse-power of some makers. The Engine, instead of being fixed to the Boiler as is usual in Engines of the same class, is erected on a massive Cast Iron Standard which makes it quite independent of the Boiler.



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Howard's Ryot's Plough, No. 0, price—Rs. 20.

These Ploughs have been expressly designed and manufactured for the use of the Ryots of India, whose special needs have been carefully studied in their construction. They embody all the qualifications for which the native-made implements have hitherto been preferred, whilst being incomparably superior in strength, durability, and efficiency.

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Stirs up the soil to three times the depth of a native plough, and leaves the good mould on the top. Goes through the dirtiest land without getting choked with weeds. Price, Rs. 15.

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ENGINEERS' TOOLS AND STORES OF ALL KINDS.

ALWAYS ON HAND A LARGE STOCK OF PLATE, BAR, ANGLE, TEE AND CORRUGATED IRON, STEEL, BRASS, COPPER, PIG IRON, FOUNDRY COKE, SMITHY COAL, FIRE BRICKS, AND FIRE CLAY.

☞ *Catalogues on Application.*

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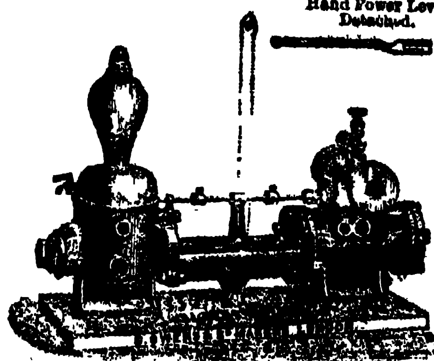
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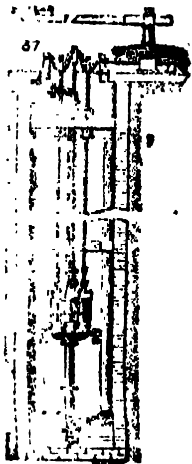
THE FOLLOWING ARE SOME OF THE PROMINENT ADVANTAGES OF THE BLAKE PUMP:—

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It works fast or slow with the same certainty of action.
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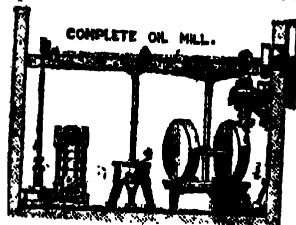
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Can be worked at 200 strokes per hour, or 20 strokes per minute.


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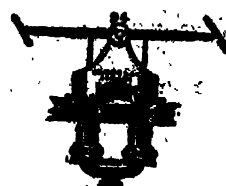
BLAKE'S PATENT
Direct-Acting Steam Pump and Boiler Feeder.

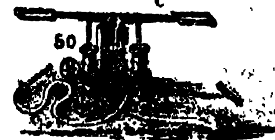

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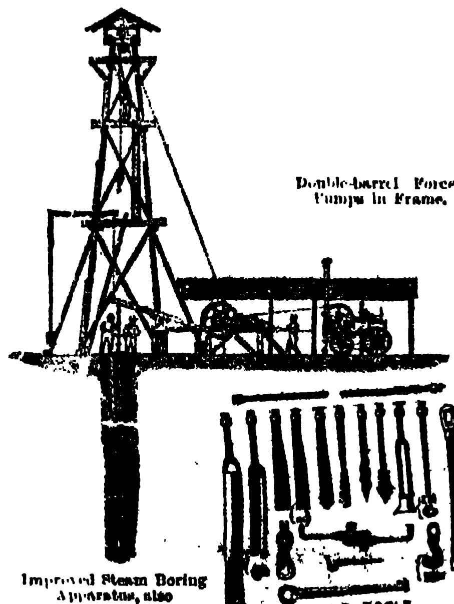
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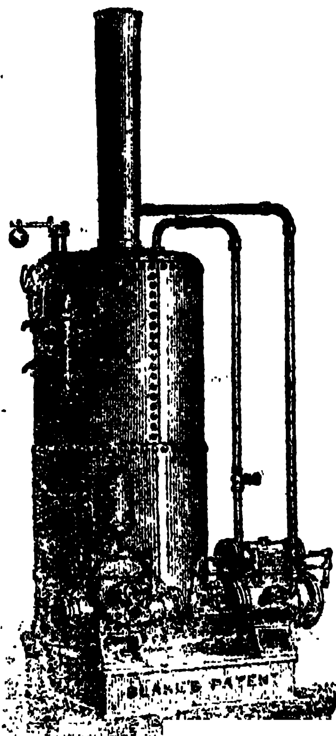

Deep-well Pumps for Hand Power.

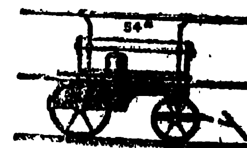

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Improved Steam Boring Apparatus, also

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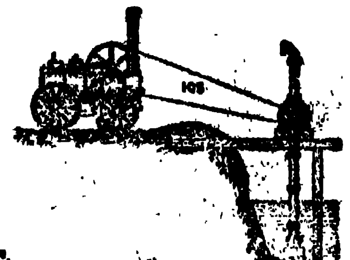


Fire Engines, for Towns, Railway Stations, &c.


Force Pumps Barrow.



Wrought-iron Portable Pumps.


Patent Centrifugal Pumps, for Contractors use, or Irrigation Work.


Cast-iron House or Garden Pump.


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BLAKE'S PATENT DIRECT-ACTING STEAM PUMP AND VERTICAL BOILER

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THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. VIII.] CALCUTTA,—SATURDAY, DECEMBER 1, 1883. [No. [illegible]

Registered No. 182.]

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VOL. VIII.] CALCUTTA:—SATURDAY, DECEMBER 1, 1883. [No. 12.

CONTENTS:

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

All correspondence must bear the full name and address of the writer, not necessarily for publication, but as a guarantee of good faith. We shall take no notice of anonymous letters.

ACKNOWLEDGMENTS.

ANNUAL Report on Labour Immigration into Assam, for the year 1882.

REPORT on the Administration of the Meteorological Department, 1882-83.

REPORT on the Stamp Department, Punjab, 1882-83.

REPORT on the Registration Department, Punjab, 1882-83.

REPORT on Public Instruction in Assam, 1882-83.

REPORT on the Cawnpore Experimental Farm for the Rabi Season, 1882-83.

REPORT on Popular Education, Punjab, 1882-83.

REPORT on the Census of Bengal, 1881, Vols. I., II., & III.

LICENSE-TAX Report, 1882-83.

CORRESPONDENCE.

KAING GRASS FOR PAPER-MAKING.

(To the Editor of the Paper Makers' Monthly Journal.)

SIR,—Many of my friends, knowing that I hold a concession from the Indian Government for the collection and production of "paper stock" from bamboo and other fibres in British Burmah, have asked me how it was I had allowed Kaing grass to escape my attention.

Mr. Buckle's communication, published in the August number of the Journal, shews ample reason for this *assumed* neglect on my part.

In 1876 the Indian Government sent me a consignment of this elephant or tiger grass (as it is called), requesting me to investigate its value for paper, and report thereon. This I did, stating that, in my judgment, although possibly it might be utilised in India locally, for a low class or quality of paper, the yield would be so small of available fibre, and the cost of reducing it to a carrying condition so heavy, that it could not possibly be imported into this country to pay.

A simple analysis of Mr. Buckle's figures fully endorses this, my opinion. These shew that "47,136 pounds of the canes as cut produced' 6,761 pounds of *raw stock*," a yield or result of 14 per cent only after cleaning, and further that the cost of the *raw* grass and the labor in producing the *raw* stock amounted to 17s. 1d. for 100 pounds, or equal to £19 per ton.

The freight *alone* of such *raw* stock to Europe, owing to its bulky character, would amount to more than the present selling price of esparto grass, but I must assume that Mr. Buckle could never contemplate shipping this *raw* stock to England; therefore, that it would be chemically treated and converted into a tow-like condition to economise transit, charges, and freight.

This operation would have to be conducted in the ordinary manner as practised with other similar materials, and in boiling alone, to say nothing of bleaching, the *raw* stock would lose at least as much as esparto, say 50 per cent; therefore, the cost of this prepared stock would be £19 per ton × 2 = £38 per ton for a material very little, if any, better than esparto, the equivalent selling price of which would be say £6 per ton × 2 = £12. I say nothing of the *cost* of the chemicals, fuel, labor, interest on plant, &c., &c., nor of freight to Europe, and general charges, all of which must, of course, be added to the above £38. The conclusion is obvious.

Kaing grass is a reed full of pith, and with many joints, which must be got rid of, as only the thin woody exterior shell contains the fibre; hence the low produce of 14 per cent. for the *raw* stock.

There are many other raw grasses in India superior to Kaing grass, but in my humble opinion *no raw grass*, or the stock produced therefrom, can come to compete with esparto.

The paper trade are much indebted to Mr. Buckle for the kindly interest he has taken in this question. India, and especially Burmah, abounds in indigenous raw fibres, many of which can be cultivated, and with Mr. Buckle's co-operation, I believe ere long we may hope to see some of the stock produced from such fibres introduced into the trade.

I may, perhaps, add that an essential point to be considered is that any fibre or fibrous stock introduced must be able to come into competition with esparto—that is to say, its cost no more, and its quality at least as good if not superior, when the old adage will hold its own, "Good wine needs no bush."

THOMAS ROUTLEDGE.

Claxheugh, Sunderland.

WHAT WE KNOW, AND WHAT WE WANT TO KNOW, ABOUT CEARA RUBBER.

(To the Editor of the Ceylon Observer.)

SIR,—We know a good deal about experiments on a few individual trees, but we want to know something about results on a larger and more business-like scale. Mr. Gilliat is last in the field, and gives us interesting information, but, like his predecessors who have written on rubber, he relates results of a few trees only, and they do not add much to our previous knowledge.

We know that the trees will probably be short-lived. So say botanists, and its very rapid growth favour the idea. If, therefore, we are to make any profit out of it, we ought to begin at once to learn how that is to be done.

We know, that whether the tree be young or old, wounds made for the purpose of extracting its milk soon stop bleeding; and therefore a very little milk can be obtained from any wound, however it may have been made; nor can we obtain much milk at any one time, however many wounds we make. Trees subjected to the severest treatment, in order to ascertain the utmost yield of milk procurable, have proved, by their insufficient yield, that we must depend for any remunerative result on frequent tappings. We know, in fact, that we must be content to take a little at a time, and to take it often. What we want to know is how much we may take, and how often.

In the first place, therefore, we must devise a method of tapping, which may be often repeated without material injury to the tree or the bark. Every kind of incision that has hitherto been tried, whether vertical, horizontal, or arrow-shaped, has proved, sooner or later, to seriously injure the bark. It is true that the cuts or slits sometimes heal pretty quickly, but they are often a long time in closing, and produce serious scars. Some slits made several months ago on trees a year old are gaping yet. Although renewed bark has formed, it does not close over the wounds, which are now three times as wide as when they were first made, owing to the rapid growth of the trees. Perhaps, Mr. Gilliat's method may succeed better, but that remains to the seen. Meantime, it is satisfactory to know that a row of punctures will yield as much milk as a vertical slit or incision of the same length, whether such incision be made down to the cambium or be a mere shaving down to the lacteals. Punctures heal quickly, without material injury to tree or bark, and may be repeated at very short intervals. Trees have been thus tapped *daily* for several weeks without their showing any difference as compared with untapped trees in adjacent lines. Even when incisions heal completely, the renewed bark, especially in old trees, is very rough and intractable. For some time it yields very little milk, as compared with original bark, and is always rough and uneven. The methods of tapping by incisions seem, therefore, to be a needless as well as an injurious mutilation of the trees.

My first prickers were intended to *tear* the bark a little, in order to produce a wound that would not close too quickly, but that is a mistake. A rough wound bleeds no longer than a smooth one; and a deep one, down to the cambium, yields no more milk than a shallower one that reaches the lacteals. [The prickers are now being made with a guard to prevent the spurs going too deep, and are made to produce a *clean* wound instead of a rough.

The quantity of milk procurable from different trees of the same age, at the same day and hour, and from the same tree on different days, varies very much. This has been ascertained, but we ought to know the cause or causes of this variation, so as to adapt our proceeding accordingly. The factors of the variation are probably the hour of the day, the state of the weather, the condition of the tree, whether in flower, fruit, or flush, and the time of the year. The part which each of these factors plays remains to be ascertained, and can only be found by persevering and systematic experiment. Occasional or casual trials are of no avail whatever for this purpose. The milk drawn in the early morning is generally thin and watery, and becomes thicker as the day advances. After 10 o'clock, it sometimes becomes too viscid, but in the evening it again flows more freely. As a rule, milk may be drawn at all hours of the day, but it remains to be seen whether it would be better to discontinue the extraction during the heat of the day. The quantity of milk drawn, so far as it depends on the operator, is regulated, of course, by the length of the vertical row of punctures. Hitherto, a double row of 4 to 5 feet in length, on one side of a tree of about 5 inches in diameter, has been found to yield about 15 grains of dry rubber per tree. The daily collection of a cooly is *about* half a pound, and will probably be increased by improved appliances and with larger trees. We want to know more about this, but, should it be found that trees will bear such extraction for 240 days in the year, the cultivation would be profitable, and there is reason to hope for such a result.

The curing of rubber seems to be a tedious business. My first collections were made in tins, and each day's collection formed a cake at the bottom of the tin. The milk coagulates so quickly that the cake, though soft, can be removed from the tin when the cooly returns from the field, but afterwards it dries and hardens slowly. Pressure causes a quantity of liquid to exude, and even when the cakes are hard they contain holes, like those in Parmesan cheese, ful of liquid. Late experiments have been made with an apparatus which forms the rubber into strings, and these, when wound into a ball, look very pure and business-like, but even these balls, when cut in two, disclose some slight remains of liquid impurity. Probably Mr. Christy's suggestion of the use of a cheap spirit might assist in eliminating this mucilaginous matter; but spirit is costly, and there does not seem to be much room for extra expenditure in the process. The cake rubber was valued at 2*s.* 6*d.* per lb., and the balls I think at 4*s.*

The foregoing is very imperfect, and shows rather what we want to know than what we have already learnt. Still, it is as far as I have got, and perhaps some of your correspondents can advance it a step or two further. W.

[It must not be forgotten that most of the experiments yet made in Ceylon have been made on immature trees. As the trees grow older, it seems reasonable to expect if not more juice from a certain surface, yet a juice far less watery—almost pure gum, in fact.—ED., *C. O.*]

The Indian Agriculturist.

CALCUTTA, DECEMBER 1, 1883.

THE ASSAM AGRICULTURAL DEPARTMENT.

ON the 20th December last year, there appeared in the *Assam Gazette*, a notification to the effect that the Chief Commissioner of Assam offered a prize of Rs. 250 for the best essay on *Vasti* cultivation in the Assam Valley. The essay was to be written in plain grammatical English, and literary excellency was very properly considered of lesser moment, than a careful and orderly statement of ascertained facts. The object of the essay was to explain the uses which the ryot makes of his homestead land, and the value which he attaches to it, and the following points were set forth as those on which information was desired :—

1. The average area of the homestead, as compared with ryots' *rupit* and *faringhati* lands; how long it takes the ryot to bring his homestead into the normal condition; and whether the cultivated portion shows any marked difference in the nature or productiveness of the soil, due to more careful tilling and manuring, as is found to be the case in other parts of India.

2. The products of the homestead whether for food or other uses, as bamboos, plantains, castor plants, betel-nut, palms, mango, and jack trees, vegetables, tobacco, sugarcane, or sesamum (*til*), &c.; the mode of cultivation of each separately the amount of labour and expense which it involves; the times at which the products are gathered, and the uses to which they are put; the mode of preparation for consumption, if the product is intended for that purpose: and the nature of the trade, if it is sold.

3. The return obtained by the ryot for the labour and money expended on his homestead; the extent to which it supplies him with articles of domestic utility, or petty trade, and generally contributes to the food and comfort of the family; what value the ryot sets upon his homestead, what price it commands, if sold, as compared with *rupit* and land under permanent cultivation; whether the resignations of homestead land which annually occur are merely formal, are due to negligence in allowing portions of the homestead to be overgrown with jungle, or occur mainly in consequence of the ryot's removal to another village; and, if so, the reasons which are sufficient to induce the ryot to abandon his home.

The above list is not an exhaustive one, but merely intended to indicate what was required. All the information recorded on these, and other points connected with the subject, were to be of as precise and definite a character as possible. The Chief Commissioner reserved the option of withholding the whole or part of the prize offered, if none of the essays submitted should come up to a certain standard. The essays were to be submitted to the Director of Agriculture not later than the 1st of July 1883.

It appears that only one essay was submitted which was found unsuitable for reward, although it contained interesting information regarding the superstitions current among the peasantry in connection with the laying out and planting of a homestead.

The offer is repeated in the *Gazette* for November 10th, and the essay on *basti* cultivation should be received in the Secretariat by 1st July 1884.

It is possible, the Chief Commissioner believes, that competitors may be deterred by the extent of the subject. He will, therefore, be prepared to accept essays on a part of the subject, as well as those professing to deal with the whole. Any competitor may submit a monograph upon cultivation and preparation of any one of the articles usually produced in the homestead area, *viz.*, tobacco, plantains, castor-oil, betel-nut, palms, and bamboos, and the various kinds of vegetable commonly cultivated by the ryot. Such monographs will not be considered as entitled in any case to the whole reward, but will receive a prize corresponding to the importance of the subject, and the ability and thoroughness with which it has been treated.

As a model for the guidance of competitors the attention is directed to the memorandum on sugarcane by the Director of Agriculture which was published in the *Assam Gazette* of 22nd September 1883. It seems to us a matter of very considerable importance that the indigenous methods of cultivation should be known and diligently studied by all who wish to see modern methods grafted on the primitive indigenous agriculture of every province of India. We venture to think that not a few failures to influence native agriculturists in the direction of reforms and improvements on primitive implements of culture and traditional methods of cultivation, are due in a large measure to attempts at improvement being made before the conditions of labour, climate, race characteristics, and traditional methods of the peasantry have been thoroughly mastered. Agricultural implements are offered to Indian ryots which are in some cases beyond the limits of their means to purchase and work profitably, or which are unsuited to the physical and race pecularities of the people who are expected to use them. It has, however, become quite apparent from the class of improved implements now offered to the ryot, that those points are receiving a greater share of attention than in previous years, and no doubt as a knowledge of the whole conditions of the ryot and his surroundings, his methods of working, his means, his farm lore, his superstitions, and all else that go to make him what he is, are better and more clearly known and appreciated, the better chance will there be of devising methods and implements which he will readily adopt. But after all, improvement is a thing of slow growth especially with races of people like the Indian peasantry, who are bound in the fetters of caste and ignorance, and wedded to the traditional usages of their forefathers.

In our estimation then, the Chief Commissioner of Assam has been wisely advised to obtain clear and reliable knowledge regarding the management of homesteads. On this as a foundation, there is good hope that improvement may gradually find a new basis. We are not however very sanguine that an essay quite after the heart's desire of the Chief Commissioner or the Director of Agriculture may be forthcoming in July of next year. The men who can write in English and who know the working of the Assam peasant's] homestead, and the methods of culture of any of the ordinary crops, are, we should imagine, very few. The sons of well-to-do peasants who are being educated in English are, we should fancy, very few, and yet it is on this class that the best and surest hopes of improving indigenous agriculture are founded. Little, very little, we fear, will be effected with the present generation of ryots anywhere in India. They will do as their fathers have done, and follow the methods and use the implements which have been followed and used for ages. If there is any hope for Indian agriculture it lies with the rising generation, and how these are to be reached would lead us beyond the scope of our present purpose. The Agricultural Department of Assam is wise in laying a good foundation of facts and realities before attempting to present the ryot with any new method, or any wonderful implement, which the lapse of years and the increase of knowledge would show even to their official imagination to be fearfully and wonderfully made.

AGRICULTURAL IMPLEMENTS FOR INDIA.

WITH the Calcutta Exhibition so closely approaching its opening, it is a matter of considerable interest to consider what way the Indian farmer can be benefited by implements and machinery, and we therefore welcome a contribution from Mr. Buck, of a list of those which have been reported to him as being suitable for introduction into this country. The list before us mentions 83 different implements and machines; but of these, 36 are ploughs of various descriptions, and the others miscellaneous machines, some of which it appears to us to be the height of folly to recommend to the ryot in his present condition. They may prove useful on large estates under European management; but where are the ryots who will purchase bullock gear costing £60 to 100 as prime-movers for driving cotton-gins costing £30 to 40; or sugar-mills at £70 to 100; or pumps at £50 to 60; or even winnowers at £20 to 30? We imagine that the office of the Agricultural Department is specially to aid the ryot, and not the European planter or merchant, for the latter can well take care of himself, whilst the former is a veritable child in such matters, and needs leading with a careful hand. Not that we object to Mr. Buck assisting the planter by letting the man of Bengal know what his brother in Madras is doing, but we believe that the planter may be left to take care of himself in such matters, and that he does not in any way represent the agriculture of India, but only a small special branch thereof. Mr. Buck is of course not responsible for the opinions he quotes in the list he publishes; but the inclusion therein of machines such as we have noted, in a manner gives the *imprimatur* of the highest agricultural officer in the country to recommending them for use in India. This is, no doubt, in a measure due to the fact that Mr. Buck has no special knowledge of agriculture himself, and as far as we know, has no one near him who could assist him in such matters; and as long as the Government of India persists in making its Director-General of Agriculture a mere departmental secretary to indite "notes" on matters agricultural, and at the same time requires him to administer the revenue system of a vast empire, so long will such absurdities accrue. Mr. Buck, it may be said, has only compiled the opinions of local officers; but they are as unfitted, as he doubtless allows himself to be, from their previous training to see what can be done in this matter. No doubt one of the greatest errors in the introduction of implements into India, has been the attempt to induce the ryot to accept articles which have been designed for a totally different set of conditions. The ryot does not care much for labour-saving machines, as his labour is to a large extent unpaid, consisting of the work of himself and his family, whereas in Europe and America labor is scarce and highly paid, and there are a great many other openings for it besides agriculture. It appears to us that for most ryots, the implements that can be recommended may be counted on the fingers of one hand. Besides a good plough, a winnower, and in some cases a maize-sheller or a sugar-mill, there is as yet but little opening, except in the improvement of the cultivator's minor tools, which are generally very rude and inefficient. There is, however, a considerable opening for the introduction into some parts of the country of old established native implements used elsewhere, but unknown there. The Exhibition should teach our agricultural authorities this. We believe that extensive collections have been made from all the provinces, and we hope that advantage will be taken of the

opportunity, to assemble all the chief agricultural authorities of the different Governments, so that a full discussion may be promoted of the subject, and that they may learn from personal contact what they are each doing. Such a Conference could not fail to be of great value, and as we learn that some sort of conference of the Directors of Agriculture in the different provinces is to be held shortly, we hope they will bring their technical advisers with them, and so turn the great 'show' to the best account to the country. There is no doubt a good deal of ignorance existing in the departments of the various provinces of India regarding what has already been done in others. This could easily be avoided, if the office of the Supreme Government did more to call the attention of the authorities in each province to the results obtained elsewhere, and so fulfil its proper function. So long, however, as it is the practice to make use of local and vernacular terms to such an extent as we see in the list before us, which is a step in the right direction, so long will the authorities remain ignorant of what is being done outside their own particular sphere. In North India, the practice is perhaps most common, but there would seldom be much difficulty in a practical agriculturist finding a proper English equivalent for all the implements in use, and it would surely be far better if the use of the maund, which varies in different provinces as the unit of weight, were abandoned, and results stated in pounds, so as to be clear to every one. The Madrassee does not know what the "khurpi" or "charpai" means, nor does the Bengali understand what a "guntaka" or "papatam" is. For a list such as Mr. Buck's, to be of general value throughout India, such words should be avoided, and their English equivalents given, as English is the only language which can be said to be at all universally understood in India. We should be very glad to know what is the peculiarity of a "beam" plough, as reported on by the N.-W.P. Department of Agriculture. All ploughs have a beam; but we imagine that what is meant is that a fixed pole or shaft, after the style of the native plough, replaces the ordinary horizontal beam in such ploughs. The point, however, should be cleared up. Absurd mistakes there are also in the list, as for instance, talking of the "loaded wheels" of a grubber. Are there some new ideas concealed under this expression, with which we are not acquainted, or is it simply that the writer did not know what he was *talking* about?

A good plough is of course the first requisite of the farmer in all countries, but the manner of it will differ according to the conditions met with. Thus we find a different general pattern adopted in America to that preferred in England, and it is scarcely to be expected that in a country so peculiarly circumstanced as India, the implement adopted in either of these countries should be suitable. As yet we do not believe that the plough for India has been designed, nor do we think that any one pattern will be universally adopted. We know that this is the opinion of practical men, although we find so good an authority as Mr. Benson in a recent report, remarking that "for the greater part of India one general form of plough would suffice.' It seems to us that he has been misled into inferring from the present general similarity of the native plough throughout India, that a like similarity in an improved plough would be equally acceptable, forgetting that the acceptance of an improved plough would denote progress, and that with progress must come divergence in form, to meet the special wants of the farmer of different soils. Do we not see in England, where the general principles to be adopted in the plough have been established for 70 or 80 years, that the varieties are almost innumerable? Under these circumstances, it is not surprising that the opinions on Mr. Buck's protégé, the Kaisar plough, should be so divergent, nevertheless we believe that the opinion of the majority of reporting officers against it, is in the main correct, for the implement is far too flimsy and weak of construction for ordinary farm use. This is natural when the price—Rs. 6—is considered; for what sort of an implement can be expected for so little money, and particularly when the materials have to a large extent to be imported? Many persons have been led altogether astray in their endeavours to devise a plough suitable to the ryot, by trying too closely to approximate their designs to the native one, both in cost and manner, sacrificing thereby a large degree of efficiency and durability, and turning out a low-priced, but extremely expensive article. A good plough must be, of all things, capable of standing hard usage, and must invert the soil thoroughly. These things cannot be done by a plough turned out for Rs. 6. It is, however, possible that, by adding a few rupees' worth of material and labour, a far better and more serviceable implement may be constructed. We believe that Rs. 12 would probably be the lowest figure that should be aimed at. It is a figure well within the means of a very large proportion of our ryots, and one which would admit of good work and material being put into the plough. To go lower is to sacrifice durability; and is it likely that the ryots will fully appreciate a plough which needs to be replaced every year or two, just as their present one does? It is true that it is far more economical for the farmer, to invest at once in a thoroughly well constructed plough at a cost of Rs. 20 or 30, but at present it would be far more difficult to persuade the ryot to invest that sum than half the amount, and to a certain extent it may be wise to pander to his weakness, though in his true interests the higher-priced plough should be pressed upon him, and perhaps a plough might be obtained for less than Rs. 20 even, if the Government of India would hunt the world over for them, and their makers. For we observe in Mr. Buck's list, a plough of Swedish make reported on by Mr. Robertson as "the best and cheapest plough yet introduced into India," and costing in Madras Rs. 16 at, we believe, wholesale rates, so that our dealers should be able to sell them for Rs. 18, and make a fair profit. While on this point we may note that in our advertisement pages, and published recently in the Madras papers, we have seen a plough advertised for Rs. 15 and Rs. 15-4, which we notice Mr. Robertson quoted at Rs. 10 in Madras; and we would venture to point out to importers that if they wish to push the sale of such ploughs by the thousand, they must accept a lower rate of profit than is customary in the implement trade in England, as they should remember that their true interests lie in the sale of numbers, and not in getting a large price for a few.

One consideration which the remarks in Mr. Buck's list brings up, is that of tail-twisting and the necessity for it. The first question is—Is the practice general or universal? The second —Is it necessary? To both of these we answer decidedly, "No!" The practice is chiefly adopted in carts and not in ordinary field work, where the goad is used, and in a very cruel manner, too. Mr. Smeaton in Burmah says that in his province there is no such practice. It is true that the ryot likes to be near his cattle; but is it not possible that this is almost entirely due to custom? If so, is it worth while sacrificing the efficiency and convenience of a plough to the custom? We do not think it is, to the extent that many are disposed to do, in adhering as closely as possible to the upright handle of the native plough. To the ryot, the upright handle is, we acknowledge, very taking, but unless he really grasps the idea that the benefit to be derived from a plough does not arise in its handle, but in its share and mouldboard, what good arises from his appreciation? With an upright handle, the ploughman loses control over his plough, and is therefore unable to do good work unless the soil is very even in texture and soft. Another point which is often aimed at, is to replace the usual horizontal beam of a plough by a fixed inclined pole or shaft, as in the native plough; and it is questionable whether this is a step in the right direction. One thing is pretty certain, and that is, that by doing so a native prejudice is met; but in doing so, efficiency is lost. The cattle are placed in a very inferior position for the exertion of their strength, and have to put forth more force to do the same amount of work, than would be needed with a plough so constructed that the line of draught were more correctly disposed. There must be, in the case of the fixed-pole plough, a great downward pressure on the fore-quarters of the cattle which they have to support in addition to performing the work of ploughing pure and simple, *i.e.*, inverting the furrow-slice. For an animal to exert its full strength in drawing anything, it is necessary that a line drawn from the centre of resistance to the point of attachment should fall very slightly below the centre of gravity of the animal, and be as nearly as possible in

the horizontal. In the plough, the centre of resistance lies an inch or two behind the share on the mould-board, about two inches above the level of the soil. It seems to us, then, that it is a grave mistake to shorten the plough too much, and to be very doubtful whether the advantages of a slanting pole, are sufficient to compensate for the undoubted strain which such an arrangement puts on the cattle. We have also the experience of various experienced agriculturists and of Mr. Smeaton in Burmah, that the long stilted European ploughs can be managed by native ploughmen with skill, when doing a good day's work. These considerations must be borne in mind by any one trying to make a really good plough; and we venture to hope that the Government of India will take this plough question up seriously, and endeavour, with the agricultural, engineering, and general knowledge at their disposal, to work out some really durable form or forms which can be placed before the ryot as the best for him at the present time, and at a price he can be persuaded to give. When this is done, English manufacturers and local makers will compete to obtain the hold of the vast market that India must become in the future. There are signs that a demand will very shortly spring up, and it will arise the sooner if the steps we suggest are taken. Beside the vital importance of the plough for India, all consideration of other machines sinks into insignificance, and we do not propose therefore to touch any other item of Mr. Buck's list.

AGRICULTURAL IMPLEMENTS AND MACHINES FOR INDIA.

A GOOD deal of attention has of late been attracted in this Presidency to the movement which has set in, particularly in the Bellary district, towards the adoption of European ploughs by the ryots, and we welcome therefore a list, which has recently been published by Mr. Buck, of agricultural implements which have been found useful in India. Though we cannot think it exhaustive or, perhaps, quite fairly compiled, it cannot fail to be useful to those who are interested in the improvement of husbandry in this country. Every one who has studied the question at all, has long ago admitted that the first and chief want of the ryot in this respect is a better and more efficient plough; for the native implement has over and over again been shown to be a very expensive and inefficient article for the performance of the work desired of it. It is, no doubt, procurable at a very low price, but it must be evident that the cheapness of any implement does not lie in its prime cost, but in the cost of doing work with it. The objects of a plough are, first, to stir and loosen the soil, and, secondly, to invert it, and thus expose it to the ameliorating action of the air; and in every country where agriculture has made much progress, the latter is regarded as being as, if not more important than, the former object. The native plough is almost incapable of inverting the soil, and in simply stirring it is very far from being economical. We are not surprised, therefore, that the greater portion of the list before us is filled up with ploughs of various sorts. It is, however, a great pity that a little more trouble and expense have not been directed to its preparation, for there is no possible means of any one finding out from the list itself, what sort of a plough it is that is being referred to; a few illustrations of these ploughs and other implements which have been found most suitable for use in different localities, or for special purposes, would have increased the value of the list tenfold.

Turning now to the implements themselves, we notice that the "Kaisar" plough, brought out by the department of which Mr. Buck was not long ago the head, is placed first; but it is curious that, though so prominently indicated as being the plough for India, out of seven opinions quoted regarding it, only three are favorable, and one of these is from the department which issues the plough, and the other two are considerably qualified; whilst the remaining evidence given is adverse. Strangely enough, no opinion from Madras is quoted at all, although we find that in the year 1880, the plough was tried at Saidapet, and reported on as follows:—"The plough is roughly finished, is without a wheel, and is unfitted to undergo the treatment ploughs usually receive in the field, while it does not turn over the furrow slice efficiently from the bad form of the mould-board." This opinion agrees with that of the Superintendent of the Kandeish farm who says that the plough is "much too light and flimsy for any soil on this side," and an opinion from the Central Provinces. In the opinions on this plough, a remark comes from Burmah to the effect that there it is not necessary that the ploughman should be near enough to his cattle to be able to twist their tails. A good deal of nonsense has been, and still is, frequently written on this subject of tail-twisting, but a good deal of experience and close observation in this part of India satisfies us that it is utterly unnecessary, and that in many localities is not practised on plough-cattle at all, whilst we have all seen at the ploughing matches held annually at Saidapet, the ploughmen of the farm driving their cattle with a whip and rope-reins. In pursuing the idea that it is necessary to the ploughman to be very near his cattle, a great deal of efficiency in and convenience of control over ploughs, has been sacrificed in India. We have shown that the "Kaisar" plough is not the unqualified success that its designers would have the world believe it to be, and it is not surprising, for they have gone to work on what we believe to be an altogether wrong principle in trying to turn out a very low priced implement. The first cost of these ploughs is Rs. 6, and no rational being can expect a really useful article that will stand the wear and tear of farming operations for that sum. Undoubtedly ploughs for India must be in the present day lower priced articles than those used at home: but it is a mistake to rush to the other extreme, and to try and turn out an implement at a price as nearly as possible the same as that of a country plough, or the result must be, as we see in this plough, a light and flimsy article which will not stand hard work, and is not thoroughly efficient. Although, perhaps, there are many thousands of ryots who cannot afford Rs. 10 for a plough, there are as many or more thousands who can well afford Rs. 10 or 20 for a throughly efficient and durable one; and it is the latter class whom it is most desirable to help and encourage, for the former are only a drag on the country, and the sooner they take their proper position as farm laborers the better. Of course, there will always be men who would rather have low-priced implements, and for these they may be made, but it is a mistake to encourage the purchase of such implements as Mr. Buck would appear to wish. In a list of the implements that have been found useful in India, we are surprised to notice the omission of what Mr. Robertson in his report for 1881 calls an "improved country plough," and which appears to have met with considerable favor in Tanjore and elsewhere, and also the omission of Messrs. Massey's ploughs, which we noticed at the time of the late Agricultural Exhibition. Perhaps it is that Mr. Robertson did not supply the necessary information regarding the implements to Mr. Buck in some special report. The fact of the omission, however, remains, and lessens the value of the list.

We have devoted so much time to the discussion of the general subject of ploughs for India that we must pass rapidly over the other ploughs enumerated in the list. The most prominent, besides the "Kaisar," among those indicated as having found favor are several patterns of Swedish manufacture, which have been selected after numerous trials of various ploughs as being, in the words of Mr. Robertson, "the best and cheapest ploughs yet introduced into India." A large number of them were imported last year by Government for illustrative distribution in the Presidency; the price of these ploughs is Rs. 8, and they are very strongly constructed, but it is to be feared that they are too heavy for general use in a good many of our districts, where only small cattle are obtainable. These ploughs are made by the Ofverums Bruk Manufacturing Company in Sweden, and contrast most favorably as regards price and material with those made in England. They were first brought to notice in the report on the Madras representative at the Vienna Exhibition, on the strength of which a number of different sorts were got out from Sweden, and underwent trial at Saidapet. These trials resulted in the selection of the plough referred to. Some of the larger patterns obtained at the same time, which were found unsuitable for general use, have after trials made in the Bellary District in ploughing up the black cotton soils, been adopted there in preference to the clumsy and inefficient large native plough (*pedda maddaga*,) and have been imported by Mr. Sabapathy Modelliar in considerable numbers for sale to the ryots, at prices ranging, we believe, from Rs. 50 to 60. Seeing how satisfactory were the results of the observations of an amateur, Colonel Michael, at Vienna, we hope that the Government of India have taken steps to secure the best qualified opinions on the agricultural implements that may be exhibited at Calcutta. Advantage should be taken of the opportunity afforded by the probable presence of the representatives of the great manufacturing firms of Europe and Australia to assemble a committee there, consisting of persons of wide general experience of the ryots, and special agricultural and engineering knowledge, to endeavour to design

a plough suitable for general introduction into the different parts of India. For it is our belief that the plough for India has not yet been devised, and that it is worth the expenditure of a great deal of time and money by Government in trying to put before the ryots a really cheap and efficient plough. Better ploughs will lead to better and more certain crops, and enable the ryot to devote a larger portion of his holding to industrial and fodder crops, thus increasing the supplies for export, and benefitting the live-stock of the country.

There is a good deal of amusement to be obtained by the initiated from Mr. Buck's list, in the ludicrous jumbling together of implements of totally different characters, and in the remarks on these implements. Thus we find the name "Farnwrist" for "Turn-wrest" given to a plough; and the "broad *wheels*" of a grubber by Messrs. Coleman and "Mortar" for the "broadshares" of an implement by Coleman and Morton. No such mistakes as these would be made by any practical agriculturist, nor would one mix up chaff-cutters and winnowers together, or put corn-crushers and sugar mills in the same category.

Next to the plough, perhaps, the most useful European implement to the ryot is the winnower; for though during the season when most of the threshing is now done, there is seldom much chance of rain, it is a great pity that the ryot is driven by the absolute necessity of having fine dry weather to thresh and winnow his corn as soon as he harvests it. With a good winnower, he is independent of the wind, and of the weather also to a great extent, and can thresh his corn at the time he finds the market most favorable to him; whilst in the case of large farmers the machine, if a good one, will save expenditure, and do the work more efficiently than can be accomplished by the wind. But though the winnower is very valuable in India, and is reported on favorably by most of the officers mentioned in the list under consideration, the only evidence given regarding threshing machines is adverse, and this we find agrees with the experience noted in Mr. Benson's Saidapet Farm Manual. Machines for shelling maize from the cob have naturally been carried to the greatest perfection in America, but we were surprised to see in a table given by the Director of Agriculture for the N.-W. Provinces regarding a machine costing Rs. 78, which he recommends for its great simplicity and efficiency, that it was capable of only shelling 780lb. of grain per diem; for on turning to the Saidapet Farm Reports for 1879, we found a record of an experiment in which the "Eagle" maize-sheller, costing Rs. 40, turned out 7,582lbs, of grain in a day, and it is remarked that the figures were not favorable. The respective amounts of grain which would be shelled for one anna at these rates would be, as far as we can make out amongst a confusion of maunds by the one used in the N.-W Provinces, 107lbs., and by the "Eagle" 1,516lbs. The fact that in two parts of India two departments exist for the same general purpose, and one does not know what has been already found out by the other years before, does not say much for the interest of the officer of the N.-W. Provinces department in their duty. Several chaff-cutters are very favourably reported on, and in time should come into use, for they undoubtedly are most valuable in economising fodder, by enabling cattle to eat and digest much more of the straw than they can when it is in its natural state. In water-lifts, there is still, we believe, a good deal to be done, for all those which have heretofore been devised have considerable draw-backs; thus, the one recommended by Mr. Robertson, although very useful for lifts of from 15 to 25 feet, is inefficient above the latter height, and is also costly to erect. It is to be hoped that some of the mechanical ingenuity which has developed simple and efficient machines for other purposes in England and America, may be directed to this subject. One thing the list confirms, by the evidence given in it, is an opinion we have before expressed that windmills, though at times they might be useful for water-lifts, can never from their uncertain action be well suited for general adoption, or where water is required regularly at certain seasons. Messrs. Thomson and Mylne's Beheea Sugar-mills appear to be meeting with a great sale in Northern India, and the reports regarding them are almost universally favorable. We learn that a sale for them is springing up in the Bellary district, from the action taken by our local Agricultural Department.

In conclusion, we may remark that Mr. Buck's list would have been far more valuable if it had contained remarks on and descriptions of the native implements which are found to be useful and efficient in different localities, for it is a peculiar thing that the use of implements is often very local, as, for instance, in this Presidency, the use of the bamboo seed-drill is almost entirely confined to the Canarese and Telugu districts, and does not extend over the whole of these districts. The collection of native implements sent to the Calcutta Exhibition should illustrate this, but there ought to be in Madras a similar collection for the benefit of the people of the Presidency, and to guide our local lights in the way they should endeavour to assist the people, of one part in bringing the good things of another, to notice. We have been trying too much to introduce from abroad things devised for an altogether different set of conditions, and do not fully acquaint ourselves first with what the country itself contains of value. The sooner Mr. Wilson and his department set to work, and make themselves acquainted with the "agricultural machines and implements which have been found useful and efficient in India" by the ryots themselves, the sooner will real progress in this direction set in.

EDITORIAL NOTES.

SYRIAN SILK.—The *Central-Blatt für Textil Industrie* gives some details as to a vegetable substance somewhat resembling silk, to which attention has lately been drawn by its having been exhibited in Greece. It is stated that this substance is a silky-haired portion of a tree-like shrub which comes originally from America, but is found in Syria and the South of Europe (*Asclepias Syria*), of the family of the Asclepiads. It is also known as the Syrian silk-plant. The substance in question is used for stuffing very soft cushions, when mixed with silk and wool. This Syrian silk is used in different tissues. The milky juice of the plant is said to be poisonous, and the tough stalks can be used in the same manner as the corresponding portions of the hemp-plant.

IT appears from a report recently issued by her Majesty's Secretary of Legation at Buda-Pesth, that the progress of the iron manufacture in Hungary has been greatly retarded by the want of suitable fuel, and, at the present time, though inferior kinds of fuel are used with advantage, yet the absence of a better description is still a great drawback to the production of iron in this country. Vegetable fuel is of necessity used by the largest iron works of the country, and of forty-eight works with fifty-six blast furnaces, only four used either coke or coal, the remander using charcoal. Ironstone deposits are, as regards their quality, variety and extent, at least not behind those of the neighbouring countries. Spathic iron is found in several districts, and especially in Gomor, Szepes, Abany, Toma, Zolom, Liptai, and Szoreny. The "ore mountain" of Dobschau, with its numerous deposits, running, in some places, to a thickness of thirty-six yards. yields ores mainly worked in the open, which contain from 2 to 4 cent of spathic iron of great purity and value. Of late years much importance has been attached to the spathic and brown ore deposits of the Zipser districts, especially in the vicinity of Vorospatak, owing to the export trade with Upper Silesia. Of still greater importance are the mines in the Hunyad district, containing extensive deposits of brown ore merging into red. These deposits extend, with partial interruptions, over an area of more than nineteen miles. The future of the Hungarian iron manufacture depends on the production of superior iron, as the cost of production is materially increased by the daily growing necessity of bringing the iron from greater distances. A very large annual export of iron ore now takes place from Upper Hungary, the amount averaging over 125,000 tons. Notwithstanding that the forests in the immediate vicinity of the ironworks are much reduced, and in some cases entirely exhausted, yet there is still an abundance of wood and charcoal in Hungary. It is estimated that the extent of forest land considerably exceeds 6,175,000 acres. The annual growth of timber in the forests is 14,000,000 cubic feet, which could produce—if only a third of this amount were used—over 500,000 tons of charcoal pig iron annually. The forest lands are, however, in almost impenetrable mountain districts, and at a great distance from every means of transport, thus making them practically unavailable for manufacturing purposes. The management of the ironworks is now almost entirely in the hands of technically educated and practically skilled men, and the results are very

satisfactory; for example, the works of the Salgo-Tarjan-Rima-Murany Company produce 200lbs. of pig-iron with not more than eleven bushels of beech charcoal. The Royal Works of Goresdia Hunyad use rather more than twelve bushels of charcoal for every 200lbs. of pig-iron, and the other works use about the same proportion. The production of these smelting works varies per blast furnace from 300 tons to 520 tons per month, according to dimensions of furnace and description of iron made. At the present time Hungary possesses an aggregate of forty-one pig-iron works, and fifty-two blast furnaces in operation. The yearly production of the whole country amounts to 167,500 tons, of which 17,600 tons take the form of castings.

In the current number of the Linnean Society's journal, amongst some "Notes on New Economic Plants received at Kew," by Mr. Thistleton Dyer, we find the following :—"Various species of *Myrica* yield a wax in different parts of the world. The berries are simply boiled, and the wax rising to the surface is skimmed off and moulded into cakes. Mixed with tallow, the wax of *Myrica Cordifolia*, L., is used at the Cape in candle-making. *M. Corifera*, L., yields a similar product in N. America, and a variety of species are utilised in a similar way in Central America. The Kew Museum possesses a candle of *Myricæ* wax from the 'W. Indies,' presented by Professor Ansted, and a moulded block of what is probably a similar material from St. Domingo. For the first authentic sample from these islands we are, however, indebted to D. Morris, Esq., F.L.S., Director of the Public Gardens and Plantations, Jamaica. The following particulars respecting it were contained in a letter, dated March 15, 1883 :—'I am sending in a separate parcel a small specimen of wax prepared by Mr. Hart from one of our native trees, which may be of sufficient interest to have a place in your Museum. It has been prepared from the seeds of *Myrica microcarpa*, Benth., an amentaceous plant, growing abundantly on the hills of Jamaica at elevations of about 5,000 feet. The seeds were simply boiled with water for about half-an-hour, and then allowed to cool, the wax forming (when cool) a cake on the surface of the water. This was melted again in an earthen vessel to allow the dross to settle to the bottom, after which the wax becomes clean and clear.' As the tree is very abundant in Jamaica, and is of no use except for firewood, it would be a very desirable thing if any commercial use could be found for the wax, as it can be prepared in such an exceedingly simple manner."

Professor Brewer, Special Census Agent appointed by the American Government, has issued his report upon cereals, which embraces many interesting facts. It appears that for the census year of 1880 the total production of the six principal cereal grains in the United States amounted, in round numbers, to 2,698,000,000 bushels, an average of 53·8 bushels per head of the population, and an increase of upwards of 94 per cent since 1870. It is an important fact in connection with this enormous increase that it was not chiefly due to the cultivation of new lands in the west and north-west, but is more largely due to grain in farming regions already occupied in 1870. The chief advance was in regions which have been some time in cultivation, and in lands ranging in value from 30 dols. per acre and upwards. The grain consumption *per capita* in the United States is a fraction over 40 bushels, but in Europe it is less than 18 bushels. It is 13 bushels only in Austria, 30 in Denmark, 24 in France, 23 in Germany, 30 in Great Britain, 16 in Holland, 9 in Italy, 17 in Russia, and 17 in Spain. The crop of five contiguous States—Ohio, Indiana, Illinois, Missouri, and Iowa—amounted to over 50 per cent of the entire American grain production. Most of the grain of the United States is grown in regions where mixed farming is practised, and on farms of moderate size. Professor Brewer explains that by mixed farming, he means the growing of green and grain crops and the production of animals on the same farm. The topographical tables of distribution show that the prairie region produces over 27 per cent, or about three-eighths of the whole. The central region, which comes next, produces nearly as much as all the other 19 topographical divisions into which the country is dissected for this investigation. In every instance the grain has its largest production at an elevation of between 500 and 1,000 ft. above the level of the sea, where more than 52 per cent of the whole product is grown. Upwards of 90 per cent of the grain of the country is grown between the elevation of 100 and 1,500 ft. Bread grains are grown chiefly in the belt, where, owing to winter's cold, comforts are secured only by labour. A little less than 70 per cent of the whole grain productions is in regions where the mean temperature of January is below 30 deg., and nearly three-fourths where the average for that month is below the freezing point. More than 40 per cent is produced where the annual temperature is between 45 deg. and 50 deg.; 74 per cent where it is between 45 deg. and 55 deg.; 84 per cent where it is between 45 deg. and 60 deg.; and over 91 per cent where it is between 40 deg. and 60 deg. Thirty per cent is grown where the annual rainfall is between 40 in. and 45 in.; 60 per cent where it is between 35 in. and 45 in.; 85 per cent where it is between 30 in. and 50 in.; and 94 per cent where it is between 25 in. and 55 in. Forty-seven per cent is grown where the mean July temperature is between 75 deg. and 80 deg.; and 86 per cent where it is between 70 deg. and 80 deg. With the exception of Pennsylvania, in all the large grain-growing States more than four-fifths of the farms are farmed by their owners. Professor Brewer calculates that not less than 80, and probably more than 85, per cent of the total grain produced in the United States is grown upon farms which are occupied and managed by their owners; and the greater portion of the grain is grown on farms of over 100 acres. How long this proportion of cultivation by owners will last is another question.

The *Moniteur des Fils et Tissus* calls attention to a description of vegetable wool called *Kapoc*. It comes from Java, and a specimen is on view at the Amsterdam Exhibition. It arrived at Amsterdam in its leathery covering, being itself enveloped in the seeds. It is then freed from both, and is carded so as to make a very light mattress wool, worth about 8½*d.* per pound. One of the houses engaged in this operation had made trials in spinning and dyeing this material, but the filaments are said to be like strings, and their industrial application is consequently a matter of uncertainty.

The *Tobacco Leaf*, published in the tobacco interest, estimates the loss on the tobacco crop of the country by hail, and later by the frosts, from the 6th to the 10th of the present month, at fully fifty thousand cases of the seed leaf crop of this year. Its telegraphic reports from the various tobacco-growing districts show the frost damage through the entire New England states, New York, Pennsylvania, Ohio, and Wisconsin, though Pennsylvania suffered the least of any of the states named. It claims that at the best not more than three-fourths of the crop planted will be harvested, which will favorably affect stocks now in the hands of dealers, and enhance the value of such of the crop as has been saved in good condition, and thinks holders of seed leaf will be justified in assuming a firm attitude in relation to prices.

California raisins are made from the Malaga grapes, and are large and of excellent quality, and are acknowledged to be superior to the foreign. They are also fresher, as they never have the ethery taste given to the foreign raisins by the sea voyage. The grapes can be grown so cheaply in California and the raisin product is increasing so rapidly that in a few years, possibly in 1885, it is confidently expected that the California raisins can be laid down in this market at $1·25 to $1·30 for a 24lb. box, at which price the foreign raisins cannot compete with them. At present the freight on the California raisins is 1¼ cents per pound, which amounts to 25 cents on 20 pounds, and it is probable that as the shipments East increase, the freight will be lowered a little. The foreign raisins pay a duty of 2 cents per pound and ½ cent per pound freight, and this on a 20lb. box would amount to 50 cents, and this 50 cents for freight and duty must be subtracted from whatever the Spanish raisins sell at against 25 cents to be subtracted from what 20lb. of California raisins sell at. It is claimed by the Californians that they can produce raisins fully as cheap as the Spaniards, and that in a few years they will

control the American market. In addition to their superior quality, buyers will be attracted to California raisins for another reason. They are honestly packed, the bottom layer being fully equal to the top, and the boxes have always full weight.—*Boston Commercial.*

THE *Breeder and Sportsman* says :—"We do not suppose that one in a hundred can tell why he eats salt himself or gives it to his stock. It is important that our food and the food of our stock shall be made palatable, for there is no question at all that the animal system will do much better upon a food that is relished than upon a food that is not. . . Another, and more important reason is, that salt is found in every portion of the system, giving us to understand that nature intends it as the vital part of the animal structure, and that it must, therefore, be supplied in one way or another. As a usual thing, the mineral elements of the animal system are abundantly supplied through the food, without any especial effort to that end. But it is not so with salt. The food of animals does not naturally contain a sufficient supply of this element. It therefore must be added, and unless it is, the animals fall off in condition. The structure is wanting in an important element of strength : just as a wall would be wanting in strength if there were no lime in the mortar, and just as the animal structure would be wanting in strength if there was an insufficient supply of salt. Careful experiment has demonstrated this. It is shown that salt is a necessary element of complete animal structure, and that without it the animal will become sleepy and weak, especially in the extremities, finally dying for want of this mineral element. Prof. Foster, of the University of Munich, conducted a series of experiments upon pigeons and dogs, to see what effect a diet as devoid of mineral as possible would have. The pigeons were fed with starch and casein, which were as free from ash as possible, and the dogs with meat from which all mineral matter was extracted. The result was always the same—the muscles growing rapidly weak, especially at the extremities, and finally, cramps and shivering showed great irritability of the nervous system. . . Indirectly, salt doubtless is an aid to digestion, for it certainly has a tendency to keep the alimentary canal from clogging, and, that free, the entire machinery of the system is freer to perform its offices.

Salt is a natural absorber of moisture, and in the performance of this office it keeps the contents of the canal from becoming too dry and packed. It also operates in a similar way upon the food while in the stomach, and thus, by enabling the solid food to secrete and retain a due amount of moisture, help the digestive organs in performing their work. No animal can remain in a condition of health and vitality without a sufficient quantity of a combination of foods containing all the elements or constituencies to properly nourish the animal. The bone, muscle and tissue must be fed in proportion, and the fuel furnished in the carbon, which supplies the heat. The vital forces abound in the nitrogenous or glutinous and phosphatic elements, which should be supplied liberally to all animals, properties which are found in corn in a very small degree. Salt, as we stated before, encourages the absorption of a large quantity of water, so that the food is conveyed in such a consistency of liquidity that it is easily and readily absorbed as nourishment. The food of all animals requires a certain degree of bulkiness, in proportion to its qualities of nutrition, and the salt aids in this expansiveness, as indicated above. As exercise or labor developes the muscles, so the grasp of the digestive organs upon a sufficient quantity of available food invigorates and increases their power of utility. Wheat, bran, oats, and the coarse kind of provender combine the properties of nutrition suited to the best results of growth and development and bulkiness of food. Then, again, salt is unquestionably useful as a means of destroying the numerous parasites which are found in the animal system. The army of animalculæ which is constantly preying upon the muscles and tissues of the body would soon devour it, if they were not expelled or killed, and parasites which increase so rapidly and work so incessantly that they sap the foundations of life. As a rule, however, nature enables the system, with proper care, to hold its own against them, and salt is undoubtedly destructive to the life of these destroyers.

PROFESSOR THOROLD ROGERS writes as follows:—"A good many persons have been making experiments on ensilage during the past year. But nearly all have tried it with a view to seeing whether green forage would keep sound in an airtight and watertight pit, duly weighted on the surface, in default of being absolutely closed. That it would keep under such conditions ought to have gone without asking.

"What ensilage does is to (1) increase the nutritive powers of green forage ; (2) to obviate waste ; (3) to save time ; (4) to increase the productive powers of the soil. It does the first, if in no other way, by making the forage more digestible ; the second, by saving a deterioration by exposure to weather ; the third, by putting the least possible time between cutting and storing ; the fourth, as a sequence of the third, by enabling the farmer to cut a double crop yearly, by giving him opportunity for enlarging his stock of cattle, and by enormously increasing the amount and value of manure.

"I know from the correspondence which I have had (at one time nearly that of a department in a Government office), that the construction of silos is going on on the new plan practised in the United States, and sketched in my little book on the subject, in India and Australia as well as generally in Europe. A day or two ago I gave leave to a correspondent to translate my book on ensilage into Swedish.

"Most English silos of which I have read are made in too shallow masonry. It stands to reason that this increases the expense per cubic yard. They should be from 20 to 25 feet deep, if they are to be made in the cheapest way. I believe that my friend, Mr. Samuel Whitbread, has made the best hitherto constructed in England.

"The main object of ensilage is to get two crops a-year off the same land. Silos are profitable if they obviate loss ; most gainful when they increase produce. I should add, however, that cattle need cleanliness and ventilation as much as human beings do, and I do not wonder at disease being prevalent in English herds, and for the matter of that in flocks, when I see the dark, filthy dens in which they are generally housed, and the wasteful way in which they are exposed to weather. Our forefathers kept their sheep under cover from November to April.

"Had silos been common in England, millions of pounds worth of fodder would have been saved last summer, and not much less worth of aftermath would be saved now. I should have thought that this was the time in which English agriculture could not afford to neglect small economies, let alone great ones."

PROFESSOR WILEY, the successor of Dr. Collier as Chemist of the Department of Agriculture at Washington, in a recent letter to the *Rural World*, of St. Louis, says : "At Paris it was found that the invert sugar was always present in sorghum juices in greater quantities than sucrose. In Italy the sucrose was found to be more than ten times as much as the non-crystallizable sugar." May not this be one of the Professor's "little jokes," like that you mentioned a short time since about the "glucose honey," which rather irritated than amused our bee-keepers ? I see by the report of the National Academy of Sciences on sorghum sugar, page 62, that in 1854 Vilmorin found in the juice of sorghum grown in the suburbs of Paris (Verrieres) 11·75 per cent of sucrose and only 4·25 per cent of glucose ; and I also now have before me the report of the director of the experiment station at Avignon, in France, who says that the sorghum juice grown by him gave 16·3 per cent of crystallized sugar and 1·7 per cent only of glucose ; and he adds that his results are "fully in accord with those obtained by Peter Collier at Washington."

I also learn that at Rio Grande, New Jersey, their results this year surpass those of last year, for they report that the sorghum which on the 26th of August in 1882 gave a juice of 7½ deg. Beaume, and 8 per cent polarization ; this year upon the 24th of August gave 10 deg. Beaume and 14 per cent by polarization.

Last year the Rio Grande people told me that they used Dr. Collier's reports on sorghum as their text-books, and had confirmed his results in their own practice. I see also that even Massachusetts has offered a bounty for sorghum sugar. This seems the "unkindest cut of all" for Doctor Loring, who, while laboring to prevent any appropriation for sorghum experiments by Congress, was unable to turn his attention to Massachusetts, but perhaps they felt justified, since I see by the report of the Mississippi Valley Cane Growers' Association (p. 59) that Henry B. Blackwell, Director of the Maine Beet Sugar Co., in a letter, says: "I have recently become convinced by the experiments of Professor Collier, of the U. S. Department of Agriculture at Washington, D. C., that the juice of well-matured sorghum is equal to that of the sugarcane." And he reports as follows concerning some cane (sorghum) of his own raising in Boston: That "the juice was analyzed by Prof. S P. Sharpless, State Assayer, 114, State-st., Boston, with the following results :"

	Per cent.
Cane sugar	18·00
Inverted sugar	2·09
Ash	·89
Gum	·84
Water	78·18
	100·00

Prof. Samuel Johnson, of the Michigan State Agricultural College, has published his report on experiments with ensilage, in which he takes strong ground in its favor, but without putting forth any argument or visionary claims in its behalf. He says :

"I am confirmed in the belief that three tons of the ensilage is equal in feeding value to one ton of hay. The yield of ensilage corn was eighteen tons per acre, equivalent in a feeding value, in a combined ration, to six tons of hay. Ensilage means the growing of an equivalent to 6 or 10 tons of hay per acre. Admit, only, that three pounds of ensilage will take the place of one pound of hay, in a mixed cattle ration, even then if animals fed with it thrive, are healthy, and present a general appearance much like that resulting from grass feeding, coming out, after four or five month's confinement, with sleek coats with not much, if any, loss of weight, and with no more shrinkage of milk yield than we ought reasonably to expect as the time from calving increases, we must conclude that there is some virtue in fodder prepared in this manner. Claim only this, and is it not a profitable and a practical method of securing large yields of corn, sorghum, and other forage crops, and preparing them for convenient and economical feeding ?

"It is to be regretted that so many extravagant statements have been made in relation to the value of ensilage—the number of cattle that could be kept from the product of a single acre, &c. Practical, thinking men have been deterred from investigating this subject and giving it such attention as it really deserves, because of the wild statements of unpractical enthusiasts.

"I am more than ever convinced that the idea I suggested two years ago, that ensilage will prove a cheap substitute for roots, will be approved by any farmer who will make the trial. Farmers who have had experience in feeding stock know how desirable it is to have some succulent food as a part ration at least, during our long, cold winters. Roots are a desirable cattle food, but an expensive crop for the average farmer to raise and handle. But few farmers have the facilities for storing them in any quantity. They must be buried in the field; and in the winter, with the thermometer below zero, digging out the roots and getting them to the stock is not a desirable task. If ensilage will give us the succulent food at less cost, in shape to be easily handled and occupying but a shall space in storage, it must prove of value. What are the farmers in Michigan to do with the coarse fodder raised on our farms, but to feed them. They are too bulky to transport to market—they must help to make beef and mutton, but the farmer needs something to feed in connection with them to make them of more value, and the ensilage will help out in this direction.

"The large number of silos erected during the last year in all parts of our country indicates that ensilage has the sanction of a number of our leading farmers, and that actual tests confirm reasonable claims as to its value as a cattle food. The farmers of Great Britain, too, are greatly interested in this subject, and it has received the favorable attention of some of the leading English agriculturists."

Mr. George Fry, F.L.S., the well-known chemist, who has been associated with Mr. Ekman in so many valuable and important discoveries, has addressed himself to the scientific study of ensilage, and in the following letter to the *Agricultural Gazette* he explains why the fermentation which takes place in the fodder stored in the silos not only does not render it rotten and unfit for food, but positively makes it more digestible ; and as this problem has doubtless puzzled many amongst our readers who have given attention to the subject, they will be glad to know that it has been solved to the satisfaction of so high an authority as Mr. Fry :—

As the nature of the fermentation in silos and the cause of the extraordinary preservation of their contents are little understood, I take the liberty of calling the attention of your readers to some observations which I made this summer on the temperature of ensilage during its first fermentation, with the hope that others who possess silos will make and publish similar observations.

In order that the conditions may be clearly understood, I may mention that my silos consists of a range of three, each 12 feet square and 15 feet deep, of an estimated capacity of at least 50 tons of ensilage each. They have solid walls, 9 inches thick, of Portland cement concrete, and the bottoms are of the same material ; 9 feet 6 inches of the walls are above ground, and 5 feet 6 inches under ground. On the front side each silo has a door of red fir 2 inches in thickness, which is closed and made secure before the filling of the silo is commenced. The silos are filled from the top.

The green crop is mown, carried at once from the field, and pitched from the cart into the silo, where it is spread as evenly as possible, and is well trodden, especially round the edges.

The silo is not filled up at once, but a fresh layer of fodder about 2 feet thick is put in every day (as recommended by M. Goffart). When the ensilage begins to reach the top of the silo, the mass sinks considerably in twenty-four hours, so that complete filling is a work of some days.

The filling of No. 1 silo was commenced on June 7, 1883, with trifolium incarnatum, of which about 15 tons were put in ; then about 3 tons of rough grass, then another ton of trifolium, filling up with clover and rye-grass. On June 30 the silo was full.

By means of a perforated iron tube with a sharp steel point, driven into the centre of the mass, I ascertained the temperature to be on June 30, at 2 feet from the top surface 31½° C. ; at 3 feet, 43½° C. ; at 4 feet, 46° C ; at 5 feet, 53° C. ; at 6 feet, 56° C.

This silo was then covered with paper, and with 9 inch planks laid closely together, sand being thrown on to the planks to the depth of about 12 inches.

On July 11 the mass had sunk about 6 feet ; it was, therefore, uncovered, and the temperature at 6 feet from the surface found to be 60° C. The silo was filled up with meadow grass, covered, and weighted as before.

The operation of uncovering and filling up with meadow grass was repeated on July 17, and this silo was finally closed and weighted with 2 feet of sand on July, 21, when I ascertained the temperature at 6 feet from the surface to be *still* 60°C.

The filling of No. 2 silo was commenced on June 30, with clover and rye-grass, and proceeded somewhat more rapidly than that of No. 1. When the height reached was 9 feet from the bottom, I ascertained the temperature at 6 feet from the surface to be 36° C. After this, meadow grass of good quality was put into this silo. On July 7, the temperature at 6 feet from the surface had risen to 65° C. On July 14, it was again uncovered (having sunk fully 6 feet), and the temperature then, at 6 feet from the surface, was 70° C.

From these observations it will be evident that the temperature in the interior of these silos was maintained for a very considerable period at from 60° C. to 70° C. (=from

140° to 158° Fahr.) The escape of heat from so dense a mass is very slow. On July 1, the temperature of the sand covering No. 1 silo was 20° C., and on July 7, it had risen to 30° C. only.

I may remind your readers that Pasteur found that if wine, of a quality very liable to acetous and other injurious fermentation, were raised (in cask or bottle) to a temperature exceeding 50° C., the vitality of the germs of fermentation was destroyed, and the soundness of the wine (if preserved from contact with the atmosphere) was in all such cases maintained. (*Vide* "Etudes sur le Vin, par M. L. Pasteur. Paris : 1866.") It appears to me that what I have stated above is sufficient to account for the preservation of the ensilage. The oxygen contained in and among the green herbage is sufficient, in the beginning, to excite a brisk fermentation (probably of a complex character) ; but the silos being air-tight, and the mass, walls and covering bad conductors of heat, the temperature soon rises above 50° C., the oxygen is replaced by carbonic acid, the fermentation is arrested, and the ferment destroyed by the high temperature. Thenceforward, as long as the silo is maintained hermetically sealed, the ensilage is preserved.

It will not be surprising if green food, which has been exposed for weeks to a temperature of 60° to 70° C. (140° to 158° Fahr.) should be rendered more digestible by cattle.

THE following Sorghum notes are by J. N. Muncey, Iowa Agricultural College, September 11, 1883 :— Crushed 5,852 pounds green cane, from which 201 pounds of syrup boiled down to 232 degrees Fahrenheit was made. With the present facilities for crushing the cane we do not get to exceed 30 per cent of the juice, being required to run the crushers too rapidly. September 15, from 170 gallons of juice from cane greatly damaged by the frost, we manufactured 135 pounds of syrup boiled down to 40 degrees Beaume. The cane raised in the college grounds and by farmers near Ames is of an inferior quality, and has been damaged by the frost. The per cent of sucrose or crystallizable sugar the syrup contains has not yet been determined. The State appropriation was not sufficient to purchase all machinery necessary for practical experiments, and consequently little is to be expected from this institution. As Dr. E. L. Sturtevant says, "An appropriation sufficient to insure an attempt at experiments, and yet insufficient to make an attempt successful, is one of the best ways to kill any interest in experimental station work that I can recommend." More details of the work will be given your readers in the future.

In this connection, let me mention to those anticipating entering into the sorghum business, to so arrange their defecators and evaporators that they may be easily separated from the condensed steam-pipe in the fall when through using them. If the coils are of iron, it will be almost impossible to have each pipe in the pan so level that in freezing they will not break.* If the pans are disconnected from other pipes and allowed to drain perfectly, no trouble will follow, and the apparatus is ready for another year's work. This is mentioned as an expensive blunder that every beginner need not make.

A DESPATCH from Washington, says the *Farmer's Review*, announces that the commission already provided for to make a thorough investigation of the extent of the existence of trichinæ in the hogs of this country, will soon be appointed by the Commissioner of Agriculture, and will enter actively upon its work. Its mission will not be so much to ascertain the percentage of hogs infested with this dangerous parasite, as the districts from which the diseased hogs come, and to discover the causes and remedy, if one can be found.

Prof. Ditmar, of the department, has already been spending some time in Chicago in preliminary work, in the effort to determine the proportion of diseased hogs killed in this city, and has already made his first report based on the examination of a few hundreds only. On this basis he finds about 4 per cent have trichinæ, which corresponds with the results reported by Mr. Billings, of Boston, who made examination of the flesh of 8,773 hogs, between 1879 and 1881.

The examinations of American pork conducted under the direction of the French Government and covering more than a million pieces, showed that but 2 per cent contained trichinæ, which is about the percentage found among the native German swine, although the German Government has made the charge that American pork is diseased the pretext for excluding it from the markets of that country ; while, as a matter of fact, as shown by official examination, it is as free from the disease as its own home product. It is believed that, with examinations conducted in this country on as large a scale as in Europe, the percentage here would not exceed that shown by the examination of American meats in Europe, the smaller number of examinations giving a higher percentage than when conducted on a larger scale.

An important admission is made by Professor Ballinger, one of the best authorities in Europe, in a work recently published, who says : "From numerous examinations of American hams, the trichinæ has been found uniformly dead. The entire importations of Paris failed to reveal one case of infection." There is no doubt that the disease, though still existing, is on the decrease. Dr. Salmon, veterinary of the Department of Agriculture, states that in former years it could be found in 8 per cent of our hogs. But while it exists at all, it is prejudicial to our American pork in the markets of Europe, as also to some extent lessening consumption in this country ; and the farmers should be found ready, in their own interests, to co-operate heartily with the Commission in any measures which may be found practical to utterly exterminate the disease in this country, if such a thing is possible, and thus remove the chief obstacle to the free movement of our hog products to the markets of Europe, and at the same time increase their consumption at home.

THE following resolution has been communicated to all Collectors in the Madras Presidency:—" Village officers should be ordered to report at once to tahsildars the appearance of any locusts in the village ; tahsildars will in turn report to divisional officers without delay. The breeding season of the locust appears to be (at least in the Bombay Presidency) the months of May and June. It is therefore in the months of August and September that the young locusts, hatched from the eggs of any locusts that may have alighted in a village during the preceding six months, may be looked for, and it is while they are young, and cannot fly that they should be destroyed by every means in the power of the villagers. Nothing appears to be more successful at that stage than the Cyprus screen supplemented by pits."

AN interesting catalogue of Agricultural implements and machines, says the *Civil and Military Gazette*, which have been tried in India, has been published by the Agricultural Department of the Government of India. The list is supposed to give only those that have been found efficient and useful ; but out of the 83 implements or machines regarding which reports have been received—though this number can hardly exhaust the list—Mr. Buck is compelled to admit that only a few—about a dozen—have found favour with native agriculturists ; whilst it is only in regard to the Biheea sugar-mill that he is able to record a "real success." Its use is established in Bengal, and is extending everywhere. It is a remarkable fact that of all the ploughs, winnowers, &c., the introduction of which into Indian agriculture has been the aim of Agricultural Departments and model farms, for many years past, only this simple substitute for the Indian *kolhu* should have been accepted by the ryot. Cheap ploughs he does not care for, expensive ploughs he cannot afford ; whilst labour-saving machinery is of little value to the cultivator, who carries out his agricultural operations, throughout the year, with little addition to the labour procurable in his own family. It is equally remarkable that indigo planters—who are the only persons who work the land on any large scale, and can afford to expend capital in so doing —have done little or nothing to introduce and popularise agricultural implements amongst the poorer tillers of the soil. The success, however, of the Biheea mill proves that when any machine is forthcoming, which really supplies a want, the Indian agriculturist is not backward in availing himself of it. These mills are sold by thousands annually ; whilst the Kaisar plough, to which is given, as is rational, the place of honour in

Mr. Buck's list, makes no real progress in the estimation of the ryot. The plough is bought, indeed, but has taken no hold on the mind of the cultivator. The old excuses are still made for throwing aside a plough which has been bought to please the *Sahib*; and it will be many years before these prejudices are overcome. The same obstacles stand in way of the more general adoption of the Swedish plough, which finds favour with the authorities of the Saidapet farm, Madras; whilst the more expensive ploughs of English make, by Ransome, Howard, Collins and Co., the prices of which run up to fifty or sixty rupees, if bought at all, are carefully preserved, to be brought out at each successive Agricultural Exhibition, where they of course receive prizes, and where their owner is as regularly praised for his enterprize in furthering the improvement of agricultural knowledge. There is, perhaps, a future for an improved water-lift. Pumps are "enquired for"—to use the commercial phrase; and those on the McCornas principle appear likely to satisfy a want, and replace the ordinary rope and basket, where water is fairly near the surface, or the basket-lift on canals.

The *Rangoon Gazette* says:—"In British Burmah we have fortunately but little to fear from the dreadful scourge of famine, but the consequences of a failure of our rice crop would undoubtedly be very serious indeed;—so much so that the reading of the reports for the past few weeks cannot but have excited feelings of grave anxiety. Although we annually export quantities of other merchandise, these are mainly the produce of Upper Burmah, and if our paddy crop failed our export business would be practically annihilated, whilst the sale of imports would be at a standstill, the people having no money to make purchases. Our merchants, therefore, must have felt serious misgivings at the unexpected cessation of the rains which appeared everywhere to be over for the season. The matter cannot have been viewed with any less anxiety by the Government, for a bad harvest would undoubtedly have been productive of great trouble for the Executive. The cultivators, unable to repay their loans, and with no money to make their ordinary purchases, would have become turbulent and unmanageable; crime would have enormously increased; and revenue would have been difficult to collect. Fortunately, refreshing rain fell in the Rangoon district during the past week, and it was the hope of every one that other districts had been equally favoured. On Friday night we made enquiry from the Director of Agriculture, but found that no special means were being taken to ascertain if the much needed showers had been general throughout the province. The matter appeared to us to be of so much importance that we telegraphed to the Deputy Commissioners in charge of the principal paddy districts, and we have to thank these gentlemen for the promptness and courtesy with which they have replied to our enquiries. Their reports, of which our readers have the benefit to-day, are of course a week later than those published in the official *Gazette*; and a comparison will show that they represent matter in a much more favourable light,—so much so, indeed, that, in conjunction with the fact that the weather continues showery, they are calculated, in great measure, if not entirely, to remove the anxieties which have been felt during past week or two; and we may look forward to an average harvest, if not an abundant one. Mr. Ireland's message from Pegu is specially cheering; the bounty of nature which brings prosperity to his district should make it less difficult to manage, and we may hope the Sittang Railway will be open in time to benefit by the traffic in grain. We telegraphed to his neighbour in Shoaygyeen, but have not yet had a reply, no doubt in consequence of the incomplete arrangements of the Telegraph Department. Ma-oo-bin, the head-quarters of the Thouegwa District, is not yet accessible by wire, so that from these two important paddy districts we have no report; but from their position we may expect that they also have been favoured with rain. As to Hanthawaddy, the Deputy Commissioner informs us by letter that "the rain that has fallen these past few days has been general throughout the district, and it is reported to have benefited the crops, which promise well."

A contemporary says:—"The advantages of deep ploughing, in resisting the effects of drought, are so fully acknowledged, that it is a matter of wonder why the intelligent *Jât* cultivators of Northern India do not adopt improved ploughs more readily. It is not altogether from the want of information; for energetic district officers have been known to carry about a Kaiser plough (made at the Cawnpore Farm), and to hold small ploughing exhibitions at each halt. The matter becomes of renewed interest in view of a somewhat deficient rainfall; and it would be a decided step in the right direction, if the advantages of deep ploughing for tap-rooted plants were brought fully home to the ryot. The cultivators of the Madras Presidency, even, are not so backward as their Northern brethren; and have bought, and used, large numbers of improved ploughs, the lowest price of which is Rs. 16. It cannot be the case that the cattle of North rn India are unable to drag the new ploughs, for they are certainly superior to those of Madras; it is probably a strong conservative feeling—as difficult to stir as the under-strata of their own soil—which keeps the *Jâts* to the use of the miscalled ploughs, of a design centuries old. There is, it is true, some doubt, even yet, as to which plough is the best of the many inventions recently brought before the ryot at agricultural shows: the Kaisar of Cawnpore, the Ryot, the Nawab, the McGregor, or the heavier Swedish ploughs so much in favour in the Madras Saidapet Farm. It is not every plough that will suit every soil; but the plain fact that crops in a deeply-stirred soil have larger resources of plant-food, and therefore, greater resisting power against drought, ought to be hammered into the ryot's mind till he acknowledges and acts upon it."

There is really nothing of much moment to note in the Report on the Cawnpore Experimental Farm for the *rabi* season 1882-83. The Director of Agriculture and Commerce, N.-W. P. and Oudh, in submitting Major Pitcher's report to the Secretary of the Government of the Province, has nothing to say that is not said quite as well in the report itself. The Director believes he has of "struck ile" in nitrogen, only he speaks of it with becoming caution and reservation. "For the production of cereals nitrogen is the one great want of soils like that of the farm," Major Pitcher says: "it will be interesting to note as time goes on how far potassic nitrate alone, unaided by cinereal (or mineral) manures, will suffice to maintain fertility. The use of nitrous earth as a manure is freely resorted to by native cultivators in the shape of a top-dressing to poppy, tobacco, wheat, jetia sawam, and sometimes I believe to maize." Mr. Warrington writes: "As the whole object of artificial manuring is to supplement the deficiencies of the soil, it is highly desirable that a farmer should ascertain by trials in the field what is the actual amount of increase which he obtains from the manure he purchases. A few carefully made experiments will teach him what his land and crop: are really in need of. Should he add superphosphate with the nitrate of sodium for his wheat? What dressing of the nitrate is most economical? Is superphosphate alone sufficient for his turnip crop, or should guano or nitrate be employed as well? What is the smallest quantity of superphosphate sufficient for the crop? Will it pay to use potassium salts for his seeds or pasture? These and many other questions can only be answered by trials on his own fields, and on the farmer's knowledge of such facts will depend the economy with which he is able to use purchased manures."

This extract, Major Pitcher says, explains in clear language what we are attempting to do at the farm, *viz.*, to arrive by degrees at some sort of estimate as to how far the wheat crops of these provinces may be benefited by the application of manures which will pay for their purchase, at the same time maintaining fertility, and not simply exhausting it. Variations will be made as experience suggests. For instance, we are now able to see pretty clearly how useless the application of calcic sulphate by itself is for a cereal crop, though the addition of it to farmyard manure appears to produce some increase in the effect of the latter, owing no doubt to its converting part of the insoluble nitrogenous humus into soluble ammonia compounds.

OFFICIAL PAPERS.

ACT NO. XIX. OF 1883.

THE following Act of the Governor-General of India in Council received the assent of his Excellency the Governor-General on the 12th October, 1883 :—

An Act to consolidate and amend the law relating to loans of money by the Government for agricultural improvements.

WHEREAS it is expedient to consolidate and amend the law relating to loans of money by the Government for agricultural improvements ; It is hereby enacted as follows :—

1. (*1*) This Act may be called the Land Improvement Loans Act, 1883.

(*2*) It extends to the whole of British India, but shall not come into force in any part of British India until such date as the Local Government, with the previous sanction of the Governor-General in Council, may, by notification in the local official Gazette, appoint in this behalf.

2. (*1*) The Land Improvement Act, 1871, and Act XXI of 1876 (*an Act to amend the Land Improvement Act, 1871,*) shall, except as regards the recovery of advances made before this Act comes into force and costs incurred by the Government in respect of such advances, be repealed.

(*2*) When in any Act, Regulation or notification, passed or issued before this Act comes into force, reference is made to either of those Acts, the reference shall, so far as may be practicable, be read as applying to this Act or the corresponding part of this Act.

(*3*) In this Act, "Collector" means the Collector of land revenue of a district, or the Deputy Commissioner, or any officer empowered by the Local Government by name or by virtue of his office to discharge the functions of a Collector under this Act.

4. (*1*) Subject to such rules as may be made under section ten, loans may be granted under this Act, by such officer as may, from time to time, be empowered in this behalf by the Local Government, for the purpose of making any improvement to any person having a right to make that improvement, or, with the consent of that person, to any other person.

(*2*) "Improvement" means any work which adds to the letting value of land, and includes the following, namely :—

(*a*) the construction of wells, tanks and other works for the storage, supply or distribution of water for the purposes of agriculture, or for the use of men and cattle employed in agriculture ;

(*b*) the preparation of land for irrigation ;

(*c*) the drainage, reclamation from rivers or other waters, or protection from floods or from erosion or other damage by water, of land used for agricultural purposes or waste-land which is culturable ;

(*d*) the reclamation, clearance, enclosure or permanent improvement of land for agricultural purposes ;

(*e*) the renewal or reconstruction of any of the foregoing works, or alterations therein or additions thereto ; and

(*f*) such other works as the Local Government, with the previous sanction of the Governor-General in Council, may from time to time, by notification in the local official Gazette, declare to be improvements for the purposes of this Act.

5. (*1*) When an application for a loan is made under this Act, the officer to whom the application is made may, if it is, in his his opinion, expedient that public notice be given of the application, publish a notice, in such manner as the Local Government may, from time to time, direct, calling upon all persons objecting to the loan to appear before him at a time and place fixed therein and submit their objections.

(*2*) The officer shall consider every objection submitted under sub-section (*1*), and make an order in writing either admitting or overruling it :

Provided that, when the question raised by an objection is, in the opinion of the officer, one of such a nature that it cannot be satisfactorily decided except by a Civil Court, he shall postpone his proceedings on the application until the question has been so decided.

6. (*1*) Every loan granted under this Act shall be made repayable by instalments (in the form of an annuity or otherwise), within such period from the date of the actual advance of the loan, or, when the loan is advanced in instalments, from the date of the actual advance of the last instalment, as may, from time to time, be fixed by the rules made under this Act.

(*2*) The period fixed as aforesaid shall not ordinarily exceed thirty-five years.

(*3*) The Local Government and Governor-General in Council in making and sanctioning the rules fixing the period, shall, in considering whether the period should extend to thirty-five years or whether it should extend beyond thirty-five years, have regard to the durability of the work for the purpose of which the loan is granted, and to the expediency of the cost of the work being paid by the generation of persons who will immediately benefit by the work.

7. (*1*) Subject to such rules as may be made under section ten, all loans granted under this Act, all interest (if any) chargeable thereon, and costs (if any) incurred in making the same, shall, when they become due, be recoverable by the Collector in all or any of the following modes, namely :—

(*a*) from the borrower—as if they were arrears of land revenue due by him ;

(*b*) from his surety (if any)—as if they were arrears of land revenue due by him ;

(*c*) out of the land for the benefit of which the loan has been granted—as if they were arrears of land revenue due in respect of that land ;

(*d*) out of the property comprised in the collateral security (if any)—according to the procedure for the realization of land revenue by the sale of immoveable property other than the land on which that revenue is due :

Provided that no proceeding in respect of any land under clause (*c*) shall affect any interest in that land which existed before the date of the order granting the loan, other than the interest of the borrower, and of mortgagees of, or persons having charges on, that interest, and, where the loan is granted under section four with the consent of another person, the interest of that person, and of mortgagees of, or persons having charges, on that interest.

(*2*) When any sum due on account of any such loan, interest or costs is paid to the Collector by a surety or an owner of property comprised in any collateral security, or is recovered under sub-section (*1*) by the Collector from a surety or out of any such property, the Collector shall, on the application of the surety or the owner of that property (as the case may be), recover that sum on his behalf from the borrower, or out of the land for the benefit of which the loan has been granted in manner provided by sub-section (*1*).

(*3*) It shall be in the discretion of a Collector acting under this section to determine the order in which he will resort to the various modes of recovery permitted by it.

8. A written order under the hand of an officer empowered to make loans under this Act granting a loan to, or with the consent of, a person mentioned therein, for the purpose of carrying out a work described therein, for the benefit of land specified therein, shall, for the purposes of this Act, be conclusive evidence—

(*a*) that the work described is an improvement within the meaning of this Act ;

(*b*) that the person mentioned had at the date of the order a right to make such an improvement ; and

(*c*) that the improvement is one benefiting the land specified.

9. When a loan is made under this Act to the members of a village community or to any other persons on such terms that all of them are jointly and severally bound to the Government for the payment of the whole amount payable in respect thereof, and a statement showing the portion of that amount which as among themselves each is bound to contribute is entered upon the order granting the loan, and is signed by each of them and by the officer making the order, that statement shall be conclusive evidence of the portion of that amount which as among themselves each of those persons is bound to contribute.

10. The Local Government, with the previous sanction of the Governor-General in Council, may, from time to time, by notification in the local official Gazette, make rules consistent with this Act to provide for the following matters, namely :—

(*a*) the manner of making applications for loans ;

(*b*) the officers by whom loans may be granted ;

(*c*) the manner of conducting inquiries relative to applications for loans, and the powers to be exercised by officers conducting those inquiries ;

(*d*) the nature of the security to be taken for the due application and repayment of the money, the rate of interest at which, and the conditions under which, loans may be granted, and the manner and time of granting loans ;

(*e*) the inspection of works for which loans have been granted ;

(*f*) the instalments by which, and the mode in which, loans, the interest to be charged on them, and costs incurred in the making thereof, shall be paid ;

(*g*) the manner of keeping and auditing the accounts of the expenditure of loans and of the payments made in respect of the same ; and

(*h*) all other matters pertaining to the working of the Act.

11. When land is improved with the aid of a loan granted under this Act, the increase in value derived from the improvement shall not be taken into account in revising the assessment of land-revenue on the land :

Provided as follows :—

(*1*) Where the improvement consists of the reclamation of waste-land, or of the irrigation of land assessed at unirrigated rates, the increase may be so taken into account after the expiration of such period as may be fixed by rules to be framed by the Local Government with the approval of the Governor-General in Council.

(*2*) Nothing in this section shall entitle any to call in question any assessment of land revenue otherwise than as it might have been called in question if this Act had not been passed.

12. (*1*) In the Indian Registration Act, 1877, section 17, clause (*l*), for the word "certificates" the words "orders granting loans" shall be substituted.

(*2*) In the same Act, section 58, for the words "a certificate" the words "an order" shall be substituted.

(3) In the same Act, section 89, first clause ;—

(*a*) for the words "a certificate" the words "a loan," and

(*b*) for the words "such certificate" the words "his order," shall be substituted.

SELECTIONS.

VETERINARY SCIENCE IN INDIA.

THE October number of the *Quarterly Journal of Veterinary Science in India and Army Animal Management* contains, as its leading article, a review of the past year's efforts to obtain a proper footing for the Indian veterinary surgeon, as well as an epitome of the principal events of the year connected with veterinary science. The editors have "every reason to believe that arrangements are pending for relieving usfrom a threatened decrease in numbers, and a consequent imposition of duties which it would have been impossible to perform with even an approach to efficiency." It is also stated that there is "reason to believe that some such Civil Veterinary Department as we have persistently advocated is in course of preparation by the authorities." Education, we are told, has much progressed during the past year, which is remarkable for the graduation of the first batch of native practitioners educated at Lahore, and now diplomated as Veterinary Assistants. There is a probablity of a Veterinary College being established at Calcutta soon. "In Madras also the standard of Veterinary education at Agricultural Schools has been raised, and Veterinary pupils have been rendered eligible for certain important appointments under Government, such as the inspectorship of cattle and sanitary posts in the city." The writer arrives at the conclusion that "it is in the direction of education that the greatest advances have been made during the past year." He does not forget to record the fact that "for the first time in history has a British decoration been conferred on a Veterinary Surgeon." We concede to our contemporary all the credit, and more which is claimed for its efforts during the first year of its existence and hope it may long continue to assist in extending a knowledge of veterinary science in this country. In No. 5, now before us, Mr. S. Gillespie, V. S., A. V. D., Kurrachee, gives the details of a case of dilatation of the stomach. Some practical observations on tetanus in India are made by Mr. Gerald, H Fenton, V. S., 3rd Light Cavalry. After detailing some of the cases he has had to deal with, Mr. Fenton says he can "add nothing to the generally accepted view that nature must practically be left to her unaided efforts in tetanus, except that experiments made by me confirm the view that the paroxysms of tetanus are controlled by chloroform, and the question naturally arises whether, if we could keep a tetanic patient under anæsthetic influence for a prolonged period, the tetanus would not of its own accord pass away, without fatally exhausting the patient as it usually does. In the absence of paroxysms nutritive and cathartic treatment might be adopted with some chance of success." Further on, Mr. Fenton states that "the treatment recommended in all but our standard professional works errs on the side of fussiness ; the only chance of cure is to keep the patient quiet." Speaking of the true nature of tetanus he calls it a symptom of disease, rather than a disease, because tetanic spasm may be due to many pathological states. "Altogether practical observation seems to confirm the view that in traumatic cases the theory of entanglement of the ultimate nerve fibres is the most feasible which has been suggested, although it hardly seems sufficient to account for the occurrence of tetanus where no wound is present." Some useful hints in connection with "Shying in Horses," are offered by Mr. D. C. Pallin, V. S., A. V. D., 14th Hussars. According to his experience, this dangerous habit is met with more frequently in India than at home. He writes :—

Experience teaches us that shying is a 'vice' in very many cases attributable to skittishness, nervousness, or simply habit ; and when a horse which does not generally shy is found to do so, we ought always to look to the state of the harness in order to make sure that nothing is wrong there. Thus the blinkers may be smaller than the animal is accustomed to, or they may be so arranged on the head straps that the animal can see imperfectly over them. Also the driver may have something to do with shying ; thus if he nervously prepares to prevent the horse from swerving at a suspicious looking object, the animal will probably think that he is required to shy and does so accordingly, the best treatment for this form of shying is to give the driver a good stiff 'peg.' In cases of skittishness, the best plan is to give the animal plenty of regular work ; and, however badly the vice may be shown at starting, it will be found much less marked after he has settled down to work and finds he has something else to do than make a fool of himself. When nervousness is the cause, as it is most often in mares, which (I fancy) shy much more frequently than stallions or geldings, it is necessary to coax the animal as much as possible—to spare the whip or spur and make much of her. Different horses swerve to or from the object which frighten them; most try to get as distant from it as possible, the cause of their disturbance being fear. This plainly shews that we ought to try in every possible way to familiarise him with the appearance of objects, to quickly and gradually work him so near that he can smell, touch, or see distinctly whatever has been the object of apprehension. In this way *only* can a nervous horse be cured of shying.

Mr. T. J. Symonds, V. S., 1st Madras Light Cavalry, continues his paper on the grasses of the Madras Presidency. He is one of the most productive of the contributors to the journal, for besides the paper mentioned above, he gives a short paper on the Amrut Mahal Cattle Breeding Establishment. Other papers discuss veterinary details, and make up a journal of which the "vets" of India may well be proud.—*Madras Mail.*

DAIRY MANAGEMENT AT ROTHAMSTED.

SIR JOHN B. LAWES contributes an interesting paper on dairy matters to an American contemporary, from which we extract the following :—

At Rothamsted the herd goes into the fields of permanent pasture about the middle of May, and remains out about six months. The cows come in to be milked twice a day. In addition to the pasture they receive decorticated cotton cake, varying in amount from 4lbs. per cow to very much less, the quantity allotted to each cow being in proportion to the amount of milk she is giving. Although we have carried out so many experiments at Rothamsted upon oxen, sheep, and pigs, we have never attempted the dairy, and I am inclined to think that it would be almost impossible to arrange a series of experiments which could not be open to objection. My dairy, therefore, has never been subjected to a rigid scientific investigation, and the statistics I shall bring forward are merely those taken in the ordinary way.

The cows are kept under cover for about six months, and are tied up in pairs—forty in one house and about ten in another. The urine runs into a large underground tank, from which, when full, it is carried on to the pasture by a water cart. The food of the cows varies with their condition, and the more milk they are giving the higher they are fed ; but when dry, or nearly so, they have only roots and hay or straw, unless it is decided not to keep them for the purposes of the dairy, in which case they are milked and fattened at the same time. When fat they sell for about 150 dols. The following is the amount of food consumed by the cows while in the stalls :—

	Tons short.
Cotton cake	13
Barley meal	11½
Bran	10½
Chaff (½ hay, ½ straw)	70
Mangels, pulped	224

In addition to this, 13 tons of cotton cake are used during the summer. It is somewhat difficult to estimate the number of acres of pasture used by this herd, as the cows have the first run of the grass, and the coarser and rougher part of the pasture is fed by other stock. Possibly each cow may consume the produce of 1½ acre.

In the winter months the milk sells for about 22 cents per gallon, a price which is hardly more than sufficient to cover the cost of the food and attendance, so that the dairy does not often get back more than the manure free of cost. The annual expense of labour upon a cow amounts to about 13 dols.

It is probable that ensilage as a substitute for roots will be fairly tried in this country during the winter. The experiments which have been published both in the States and in Canada appear to show that ensilage is inferior to roots as a food for milking cows. Still in the United States, where a crop like corn is available for the purpose, and where great difficulties exist in the production of roots, ensilage may prove of much value, while it may be but of little value under the different conditions that prevail in England. Roots are our cleansing crop, but rye—which would probably be the crop most suitable for ensilage—is not a cleansing crop like corn.

A dairy cannot be carried on with profit unless a supply of some succulent food is available for winter consumption. In the proximity of towns, brewers' grains are largely employed for this purpose ; but the cost of carriage confines their use to localities not far removed from the place of production. At the present time I find no food so suitable for our purposes as mangels. The course I pursue is to manure highly, but not to aim at getting large roots. The plants are thinned out to stand 1 foot apart from each other, with a space of 27 inches between the rows, and, the produce amounts to from 20 to 30 tons per acre.

The success of a dairy depends very much upon individual attention to the animals. A cow that is not a good milker should be fattened or sold. The food should also be regulated by the milk-producing powers of the cow, and as the milk declines the more costly food should be reduced. Special care should also be taken that the cows are thoroughly milked, as a careless milker will sometimes not draw more than half the milk that the animal is capable of yielding.

The diet of a cow when yielding milk should contain more nitrogen than the diet of a fattening animal, as milk contains more nitrogen—in proportion of its other constituents—than the increase of a fattening animal. A fattening animal also increases with tolerable regularity throughout the whole period in proportion to its weight. But with the cow the process is totally different, as it may commence by giving from 3 to 4 gallons of milk per day for some time, and end by giving none. Four gallons of milk per day would in a week amount to 28 gallons, which would contain 35 pounds of dry substance. A fattening cow would not, in the same time, increase more than 15 or 16 pounds, of which amount not much more than one-half would be dry matter. As, further, the nitrogen contained in the milk would be from six to seven times as much as the amount of nitrogen contained in the meat, it is evident that the regulation of the food of a cow to its varying

condition in regard to its milk supply, constitutes a most important item in the economy of a dairy.

The amount of nitrogen contained in cotton cake differs but little from the amount of that substance contained in dry milk—which is about 6 per cent. In bran it is about 4 per cent; in barley, 2 per cent; in dry Mangels also about 2 per cent., and in hay and straw, 1 per cent, and ½ per cent respectively. It is evident, therefore, that by increasing and diminishing the three former foods, the requirements of the animal in the various stages—ranging from the time of its yielding an abundant supply of milk to when it becomes absolutely dry—can be fully met.

The actual amount of dry matter consumed daily by the herd, during the six months of winter, amounts to about 31 pounds per head; but, as I said before, the quality and quantity of food are regulated by the milking properties of the particular animal.

RED CLOVER.

Sir J. B. Lawes has the following article on red clover in the *Agricultural Gazette*:—

Any one who walks over a field of red clover soon after it has been mown, may observe how rapidly fresh growth in the crop takes place. In twenty-four hours, and probably within even a shorter period, a leaf of considerable size has sprung up. This growth arises from matter stored up in the root; and it is in connection with this store of matter that I now propose to make a few observations.

In our ordinary four-course rotation experiments commenced in 1848. After taking a clover crop in 1850, beans were substituted in their place until the year 1874, when clover was again grown, and the crop was repeated in 1882.

In our rotation crops there are altogether six experiments. On two the roots are very highly manured; on two they receive superphosphate of lime; the other two experiments are left wholly unmanured. On three of the experiments the whole of the roots, as well as all the other crops grown, are carried off, and on the other three they are fed on the land. It is evident, therefore, that when the crop of clover was grown in 1874, the land of the six experiments was in very different states of fertility. From one of the unmanured plots twenty-six crops had been carried off, and in 1882 this removal had increased to thirty-four crops. Both in 1874 and in 1882 the plant of clover was good upon all the experimental plots. In 1874 the clover was mown twice. As the first crop is cut about fourteen months after the seed is sown, and the second only about two months later, under ordinary circumstances the first crop is very much the larger of the two. This rule holds good on all the highly-manured experiments in both years, and it also holds good in three out of the four superphosphate experiments, but it fails in the 1882 crop, where the roots were carted off, and it also fails on all the unmanured experiments of both years.

If we take the highly manured turnips which were fed on the land in 1874 as representing the soil in the highest condition of the series and assume the first crop of clover hay to be 100, the second crop would be represented by 40. But at the other end of the scale where no manure had been applied and all the product had been removed for thirty-four years, assuming the first crop to be 100, the second crop is represented by 233! The second crop is in fact considerably more than twice the weight of the first crop, and the regularity with which the relation between the two varies in proportion to the food at their disposal, precludes the idea of this large excess in the weight of the second crop being accidental.

I do not propose to offer any explanation of this very curious property of the plant, but merely to point out that many of our agricultural operations are so conducted as to produce an unnatural growth. The natural tendency of the clover is to produce seed, and our large cross of clover are little more than stem and leaf. With abundance of manure, succulent growth of some kind is not difficult to obtain, as may be seen in the gigantic roots exhibited at agricultural shows. But on the other hand, it is very easy to overgrow, more especially when the production of ripe seed is the object; and with our fluctuating seasons it is by no means easy to attain the happy medium which on the one side is bounded by too little and on the other by too much.

On our unmanured rotation the first crop of the clover hay only weighed 7 cwt. per acre, but the plant was perfectly good. It is evident therefore that clover sickness is not altogether due to poverty of soil. No doubt the mild winters of 1873-4 and of 1881-2 were favourable to the underground growth of the plant. That there is a great deal still to be learnt in regard to the properties of the leguminous plants will, I think, be at once evident when I mention that at Rothamsted several of these plants—including tares, sainfoin, Lucerne, and Bokhara clover—are now growing luxuriantly in a field which has long ceased to grow red clover.

In a paper read by Dr. Gilbert at Montreal last autumn, and recently published in London by Messrs. Harrison, St. Martin's-lane, he shows that the first 9 inches of a garden soil, which has grown clover for many years, has lost very large amounts of nitrogen; while, on the other hand, the surface soil of a field which had grown barley followed by red clover had gained nitrogen, as compared with a portion of the field which had grown two crops of barley; and this notwithstanding the fact that the clover removed from the soil much more nitrogen than the barley! Nor was this all, as the barley that followed the clover was far superior to that which followed barley! How, then, are these two conflicting results to be reconciled? If clover were again sown with the barley it would be almost sure to fail; while the clover in the garden soil still continues to flourish most luxuriantly, although it has been grown there for nearly thirty years in succession! Are we to suppose that the clover in the garden soil finding all the nitrogen it required close to the surface was not compelled to look for it lower down in the subsoil? It is possible that such may be the case.

A still more remarkable experience, however, in regard to red clover has yet to be recorded. Since 1848 we have attempted to grow continuous bean crops, but comparatively with but little success. It is true that the crops have not altogether failed, as was the case with the red clover—but we have not been able to grow continuously good agricultural crops by means of manure; and for the last two or three years no crop whatever has been grown, as though grass seeds were sown last autumn they entirely failed. During the spring, the soil in various places was sampled to a very great depth, and barley and red clover were sown. I was prepared for an indifferent crop of barley, as the partial analysis of the soil and subsoil showed that the amount of nitric acid they contained was small, but—I was going to say I was surprised; this would, however, not be correct, as nothing with regard to red clover could surprise me—I will say therefore that I have been much struck by the great luxuriance of the clover which has just been cut with the barley. Even upon the bean land which has received no manure since 1848, and where the beans did not exceed a few inches in height, the clover is most luxuriant, while the colour of the leaf is of a rich dark green such as I have hardly ever seen before.

At the present moment we have therefore the following problems requiring explanation—(1) Red clover growing for thirty years upon an unmanured garden soil; (2) Red clover refusing to grow on land where four or five leguminous plants are flourishing with the greatest luxuriance; (3) Red clover growing with great luxuriance where beans refuse to grow at all; (4) Red clover removing large quantities of the nitrogen of the surface soil of the garden. (5) Red clover increasing the nitrogen of the surface soil when grown on the farm land.

There is one very important fact, at all events, that the experience of forty years has taught us, and that is, that plants are endowed with number of remarkable properties, which are only brought out when they are placed in circumstances where they can be observed.

NOTES ON POULTRY KEEPING.

FIRST and foremost among the different species of the animal kingdom submitted to the caprice and dominion of man, none have shown themselves so rich in variety as the different races of fowls. They have been produced in hundreds of forms and colours, without any discredit to either of them, because all these varieties have their relative merits. Naturalists acknowledge nine sorts or races of fowls, which it will be useless to enumerate, the object of these notes being to point out to farmers and cottagers those most suitable for stock, so as to derive a profit commensurate with the undertaking.

We know nothing of the origin of the fowl; but we suppose the parent stock to come from the jungles of India, and we must take it that all the races of birds created by the different crossings had their origin from thence. As stock birds, we should advise farmers to obtain the following:—Leghorns, Hamburgs, Game, Dorking, Spanish, Houdan, Crèvecœur, Brahmas, Cochins, and Dominiques—this last is an American bird.

Many opinions have been expressed by fanciers of poultry as to what breeds are considered the most useful in a marketable point of view. Doubtless we have gone through a 'poultry mania,' the aim of which has been to breed for feather, and to produce a perfect animal in all points, and most seductive to the eye, the real and valuable point being lost, *viz.*, the rearing of of poultry as producers, both for eggs and as articles of consumption. To rear birds exclusively for the show pen is an expensive pleasure, for it requires a good purse to maintain such a fancy. Poultry bred under such circumstances, and treated with the utmost care and trouble, like exotic plants, must be kept warm, without being exposed to the sun's rays for fear of spoiling their feather or faces; they are daintily fed, and at the least sign of indisposition; the chemist's shop is ransacked to find antidotes to all their ills; should they have a delicate plumage, they are at times washed and dried with the greatest care; finally, natural food not being sufficient, condiments are added to force their energies, &c., &c. We maintain that poultry thus reared are useless as stock birds on a farm.

The above-named races of birds have been increased and multiplied so much that we can only, in our present notes, speak of a few prominent and profitable breeds, advantageous on account of being good layers and first-class table birds. This is a great consideration is selecting stock.

From experience we can say that the 'Brahma' has been found a most useful bird indeed, either for pure bred stock or for crossing. They lay well in winter, are good sitters and careful mothers and will bring up early chickens with little trouble; they seldom wander from home and are too heavy to fly, but care must be taken that they are not fed too exclusively on maize, as it produces much inside fat, and, like many other breeds, the laying is impeded.

The 'Houdan,' one of the French breeds, cannot be spoken of too highly, both for laying and meat-producing qualities. Their eggs are large and white. They are reared without difficulty, and feather easily and early. Their plumage is usually white, with black spangles. They have a fine crest or top-knot, particularly the hens, and the comb of the cock is very handsome, having what is called the strawberry leaf shape. Beyond their usefulness, they are very attractive on a farm, and make a fine show. At four months old the pullet will weigh from 4 lbs. to 4½ lbs., and the cockerel from 6 lbs. to 7 lbs. The flesh is remarkably white and

delicate, and there is less waste of offal. The bones are particularly light. They have five toes like the Dorking, the legs white with the exception of a few black splashes. These birds are hardy, and are more easily raised than any other French breed. They do not wander, and are much less destructive. The greater part of these crossed with the Brahma make magnificent specimens, imparting to the Asiatic breed its delicate flesh and large full breast. Mr. Lewis Wright, the eminent writer on poultry, particularly recommends the cross of the Brahma and Houdan, that is, a Houdan cock and Brahma hen.

The Crévecœur comes next. This is another of the French breeds. A large, square-built bird, well set on short, firm legs, full breast, limbs well developed, four toes, legs black, carriage upright and proud, is even more precocious than the Houdan, and as he is a larger bird, his flesh is more abundant, so that at the same age he weighs more than the last named kind. His plumage is entirely of a lustrous metallic black. The cock has a fine crest, inclined to fall backwards, with a comb in the shape of two horns, —that of the hen much smaller in proportion; but the crest is fuller, and stands erect. They produce certainly the most excellent poultry seen in the Paris market. Their bones weigh even less than those of the Houdan; the flesh is short, fine and white; and they fatten easily. Indeed, if well fed in the yard, they do not require to be put in the fattening pen at all, and at six months they are like young turkeys for size. The pullets are of an unheard-of precocity, as they can be put up to fatten at two and-a-half to three months old, and at the end of a fortnight are ready to kill. This is perhaps the best breed for crossing, and experience has proved that, crossed with a Brahma hen and Crévecœur cock, the produce is large, hardy, and magnificent birds, and as a cross have been sold at 7*s.* 6*d.* each, and many more could have been disposed of could they have been had. Therefore this breed can always be strongly recommended, and will prove remunerative in a commercial point of view, as the cockerels can be disposed of at from three to four months old, and the pullets not required for laying, even earlier. The eggs are white, and very large.

The 'La Flèche' is another of the French breeds, and a most wonderful bird it is for size and delicacy, often weighing from 8 to 10 lbs., a bird much prized in France: but as it does not thrive well in this climate, we would not recommend it to farmers, especially so far north.

The 'Spanish.'—We presume from the name that the bird is a native of Spain. Be that as it may, we are satisfied that this breed is necessary on a farm where eggs form part of the staple commodity, and crossing brought to a good issue. The Spanish is a fine large bird, strong and hardy when fully developed, but delicate to rear, as the chickens feather tardily, and are subject to croup through the inclemencies of our climate; therefore great care is required that they should be warmly housed until they get their feathers. In general, Spanish are never bred too early in the year. Their plumage is deep black, with glossy reflections. Legs blue or dark lead colour. The comb in both sexes must be large, but in the cock it is perfectly upright, separated, and extending from the base at the upper mandible to the back of the head; that of the hen, when fully developed falls completely over on one side. This bird is remarkable for its white face, which should extend over the eye as far as the comb, and reaching down to the wattles. To be perfect, the face ought to be of a pure white, without wrinkles, and soft and smooth as chamois leather. The eggs are white and large, and the hen of this breed is considered to be very prolific. It will be as well not to give too many hens to a Spanish cock; four are quite as many as he can manage.

A Brahma hen and Spanish cock produce a capital cross, what is called 'Cuckoo,' some with white legs, some with yellow, and we fail to see a difference between this cross and Dominiques and Plymouth Rocks. However, these crosses thrive wonderfully well, and at three months are almost double the size of their congeners of the pure breed. C. W.

THE POULTRY OF THE FARM.

THE next matter to be considered in poultry-keeping is the housing, and this is a very simple affair; still there are many incidents to be noticed, and for which provision must be made. Next to food, the housing of poultry is very important, and the two combined form the secret of poultry farming with advantage.

Poultry-houses, that is, roosting and laying houses, are made with very cheap materials, and can be thatched or tiled; for a cold country we should advise thatch, as being warmer in winter, and cooler in summer. Let ventilators be made all round the building, which can be opened or shut according to the season.

The roosting house must be so prepared that perches can be placed in amphitheatre style, so that those breeds which perch high may avail themselves of the highest positions, whilst the heavy birds such as the Asiatic breeds perch low, and can be easily accommodated; besides, the perches thus made prevent the fowls from dropping their dirt on one another. To keep the roosting house as clean as possible place under each perch a thin plank covered with dust or ashes, so that the droppings can be collected with ease and secured in a barrel, and which can be disposed of at any time by use or by sale. In the laying house [illegible]ce small boxes in tiers for the nests, not too high, or the birds would not be able [illegible] them. On the upper tiers have a small landing [illegible] at the entrance, so as to prevent the fowls ent[illegible] too abruptly; otherwise they run the risk of breaking the eggs should there be any in the nest.

On the top of these boxes a shelf can be fixed from one end to the other, on which small round baskets can be placed, lined with hay or cut straw, so as to induce the fowls to lay in them, for fowls are such capricious creatures that very often they will not enter a box that has been made for them to lay in, but will rather go and seek out a nest for themselves. These baskets on the shelf are a great inducement, and they often take to them in preference to any other. However, it is better to adopt any plan than to allow your hens to steal their nests, and thus lose the eggs.

We are just entering upon a season when new laid eggs are in great request, and all poultry farmers ought to adopt the means to promote their production, and it would amply pay those persons who give special attention to it.

At this time of the year all pullets hatched in March and April should be well housed, with a south aspect as much as possible, and well sheltered from the north and east winds.

The floor of the house should be covered with dry leaves, which are easly obtainable at this period of the year, or with the hull of corn.

Fowls delight to scratch in this and pick out the corn that may be thrown to them, for nothing keeps poultry in health so much as moving about and having plenty of exercise.

The ventilators during the cold weather should be shut.

A dry soil is indispensable for egg production, therefore the poultry yard should have from time to time a layer of the soil taken up and used in the kitchen garden, and replaced by a layer of gravel or ballast, so laid down that the rain water may easily drain off.

In addition to the fowl house, it is very advisable to have an open shed, for fowls require to live in the open air as much as possible, and the only object of the shed is to replace the large trees under which fowls in summer take refuge from the rain and sun. The shed can be used in summer as a roosting house, with the addition of a few perches. Dry leaves or the hull of corn should also be thrown into the shed, and the base of the shed bordered up by a plank, so as to prevent the fowls from scattering it abroad.

A supper of boiled potatoes, well mashed up, and mixed with middlings, will do sometimes; at others, all sorts of vegetables, boiled up and mixed with scraps of meat and fat. In Scotland, where oatmeal is cheap, it would form an excellent food. All these ingredients must be given warm.

In the morning, give them wheat, oats, buckwheat, and sometimes a little hemp seed, but sparingly. Barley and oats, half boiled, are very exciting, and good for the laying. Be particular and give them good and clean water. Change the hay or straw of the nests often, and have a care how the eggs are handled, for in winter the shell is very thin.

With the above precautions, farmers ought to have plenty of early eggs which would find an easy and remunerative market.—C. W.—*North British Agriculturist.*

POULTRY IN INDIA.

POULTRY are entitled to a fairly prominent place among our food supplies. The Indian *murghi*, however, cannot hold a candle to the produce of our fowl-yards in England, although the parent stock of all those magnificent birds came originally from Asia. It was only in 1847 that any keen interest was felt in England and America in improving the domestic fowls. Many of our readers will remember the excitement caused by the introduction of the Cochin Chines: they are justly entitled to be called "the parents of poultry fancy." Previous to their advent there were few who cared for keeping fowls; indeed it was looked upon as a harmless mania, much the same as the keeping of white mice. Within the last ten or twelve years, a greater interest has been developed in improving our Indian poultry-yards. People have begun to find out that by a small outlay and a little care an egg superior to that laid by the country hen and a finer bird than the *murghi* for the table can be procured. It is true that the climate of the plains is somewhat against us in many parts of India, but it has been proved that the English varieties can be made to succeed if proper precautions are taken. The improvements that have so far been developed are due to the energies of a few who have taken the trouble and gone to the expense of importing superior stock: these have by degrees been spread throughout the country. Ten or twelve years ago it was a rare thing to come across English fowls but now in fifty per cent of the poultry-yards either half-breeds or pure breeds will be found. After the first outlay in purchasing the birds the cost is very much the same, whatever kinds are kept; the English ones will, it is true, eat a little more, but they give a better return in larger eggs and more meat. Houdans, Bramas, Cochins, &c., are now really within the reach of all. From two to ten rupees is the price ordinarily asked for birds according to their size and purity of breed, and it takes a very short time for them well to repay the purchaser the money he has laid out. Importation is a more serious matter. It is no use getting out any but birds of high class strains; but these may be got on an average for a sovereign a piece. Carriage by sea or land is an expensive item. Allowing for deaths, agency fees, and remuneration to the ship's butcher who looks after them on the way out, half-a-dozen birds could not be landed at a station far from the coast much under two hundred rupees. Though it appears a large sum, the investor may with ordinary luck recoup himself in a year, and have a balance to profit and a well stocked yard. The only place, we believe, where poultry-farming has been carried on on a large scale is at the Chowkoorie poultry yards near Almora, at an elevation of over 6,000 feet. It has proved successful. The proprietor has found no difficulty in disposing of as many young fowls as he can produce from his French Houdans at Rs. 30 a trio. Imported birds do better (as is but natural) in the hills, the climate being more suited to them. They are less liable to degenerate, and the young

stock is more robust. It would almost pay residents in the plains better to purchase fowls bred from imported birds in the hills than to get them out direct from England.

Houdans and Bramas (light and dark) appear to be the varieties very generally selected by importers. The former takes its name from a district in France, and is of modern origin, having been first described in 1865. It is, however, a very characteristic breed. The birds may be recognised at once by their triple comb, full-crest whiskers and beard, black-and-white-spangled plumage, and five toes, the two hind ones being one *above* the other. It is worthy of note to show how breeds are made up to suit the requirements of judges at poultry shows, that the original Houdans had scarcely any beards or whiskers, and the fifth toe was uncertain. Houdans are non-sitters, and lay large white eggs; the chickens are very precocious, and if properly fed are fit for the table at four months.

The origin of the Bramas is not quite so clear. They first appeared as a distinct breed in 1846 in America, and were said to have been brought over by a sailor who obtained them at Lukhimpore, on the banks of the Brahmaputra river. There was a long and bitter controversy as to where they first came from; some asserted Chittagong, others Shanghai; indeed for a long time they were called grey Shanghais. One thing is certain—we cannot now find fowls answering to their description about the Brahmaputra, or we should not send all the way to England for them. This breed thrives in India and is more hardy than the Houdan. Their propensity to sit interferes a great deal with the production of eggs; they make excellent table birds if properly fattened. They are magnificent fowls to look at, with their heavily-feathered legs and stately carriage. A good Brama cock will scale 12 to 14 pounds. An excellent cross may be obtained by mating a Brama hen with a Houdan cock. The progeny are almost invariably black with crests, and are non-sitters.

The great thing to guard against is degeneration. Poultry seem to be more liable to it in India than in Europe. It is attributable to three causes: climate, bad feeding, and breeding in and from limited stock. In importing fowls it is advisable to order, say, three cocks from different yards and three or four hens. Mate the hens with one cock; put the pullets reared with No. 2, and so on with No. 3. In this way three strains can be established, and the breed will be kept up to the mark of the original stock many years if otherwise properly treated.

Artificial incubation has made great progress in the last two or three years, and it greatly simplifies the production of a large number of chickens. Mr. Thomas Christy, of Fenchurch-street may be justly called the pioneer of the hydro-incubators in England (though, as is known to most people, the hatching of eggs by artificial heat dates back to the times of the ancient Egyptians). But last year a great advance was made in the invention by Mr. C. Hearson of an automatic incubator, which regulates the heat of the egg-drawer of itself. No changing of water or circulating boilers are required. A small lamp (kept constantly burning) is connected with a flue through the tank, and arranged so as to heat the water. The following is the way in which the heat in the drawer is regulated. On a little stand over the eggs, and near the bottom of the tank, is a capsule of thin brass, enclosed in which are twenty drops of a liquid which boils at the temperature at which the egg-drawer is to be kept. A piece of stiff wire stands in the centre of the capsule, and is connected with a light lever at the top of the machine, at the other end of which hangs a damper over the lamp chimney. When the drawer is underheated, the damper closes the chimney and all the heat goes into the tank. When the proper temperature has been arrived at, the capsule boils, swells, acts on the lever, raises the damper, and allows the heat to escape from the lamp instead of acting upon the water. If a greater heat is required, a small weight which is on the lever is moved forward, when greater pressure will be required to raise the damper. The arrangements also for keeping a current of damp air over the eggs are simple and thoroughly efficient, only necessitating the addition of a little lukewarm water about once a fortnight. Taken altogether this incubator may be said to give a minimum of trouble and a maximum result. Like all new patents it had but a short reign in its entirety. Mr. Christy at first scoffed at it, but soon found that his old style of incubators were being thrown out of sale, and therefore he had to provide something like Mr. Hearson's champion incubator, but sufficiently different not to infringe the patent. He calls his "the thermostatic incubator." None of these have, as far as we know, found their way to India, but there are a few of Hearson's working very successfully. Those who may get them out should be provided also with a "foster-mother," in which 50 or 60 chickens can be reared with great ease. The general mistake made in bringing up chickens is that they are entirely trusted to the tender mercies of the "murghi-walla," and in consequence they are not only under-fed, but badly fed and grow up stunted and degenerate fowls. Everything depends on the treatment for the first two or three months. Constant feeding with good food and frequent change of diet will reward the rearer amply, and give him in return birds as good as those that come out from England.

Considering the number of poultry fanciers there are now in India and the difficulties that exist in getting fresh stock, we would suggest the formation of a poultry club. By means of this, the members would be enabled to exchange birds and get in fresh strains, and to join together for purposes of importation. It would give an impetus to poultry-farming for pleasure and for profit, and enable many who do not know now where to get good fowls at a moderate price to supply their wants.

It has been satisfactorily proved that eggs for setting cannot be trusted to the post-office. In almost every instance parcels containing eggs have reached their destination with the yolks broken and unfit for incubation. Taken by hand with ordinary care they may be transported from one end of India to another, and be found fit for setting at the end of the journey.

Before leaving the subject it is worth noting that a great many eggs might be saved for household purposes which are left to addle under the hen by testing them after they have been five or six days incubated. They are quite fit then for cooking, and will be found very little inferior to fresh eggs. Testing is simple. Light a lamp or candle; put it in a box with a round hole in front of the light, and one at the top to let off the heated air; make, in a piece of black card-board or tin, a hole the shape of an egg; in one hand hold the egg and in the card-board in front of the light the whole of the interior of the egg will be visible. If fertile, the vein will be distinctly seen looking like a spider; if unfertile, the appearance will be the same as that of a fresh egg. Remove all these and send them to the kitchen for use. If two hens are set at the same time and many unfertile eggs are found, the remainder can go under one hen, and a fresh lot be started under the other; much waste of labour being saved. The hen won't mind the extra six days; she careth not for time. The American saying about an unpunctual man is "he has no more idea of time than a sitting hen."—*Pioneer.*

VEGETABLE EXTRACTS.

WHILST it is admitted on all hands that the cultivation of economic plants, yielding sugar, fibres, and drugs, and their by-products of all kinds, according to the climates and soils suitable to their cultivation, might be profitable, the obstacle that the grower and the capitalist alike have had to face, has been the almost insuperable difficulty of extracting the several products at a cost of production that will leave a profit at all commensurate with the risk incurred. When we take into account the amount of unprofitable vegetable matter associated with the more valuable part of the plants to be dealt with, the cost of labour and the carriage of the crude material to the nearest mill and the comparatively poor results, the costly and by no means perfect machines return upon the outlay, we are the less surprised to find how quickly the enthusiasm of the most hopeful is cooled after the first or second essay in any of these directions.

The efforts made by the Government of India to improve the condition of the fibre producers, who had expended large sums in cultivating 'china grass,' affords us a capital illustration. Their evident desire to promote on a larger scale the cultivation of plants which from time immemorial had produced valuable fibres for native textile fabrics, led the Indian Government to offer a prize of some five thousand pounds sterling for the production of a suitable machine to remove the fibre from the woody matter associated with it, in the *Bhamia* plant particularly. It was in the year 1870 the offer was made. The machine was to be of such a character that it could be used in the rainy season, when the plant was still green, at a time when the difficulties of heating the plants are insuperable except by artificial means. The first trial was made at Saharanpore in 1872. The results obtained were considered unsatisfactory; but Messrs. D. and J. Greig received a prize of £1,500 for a crushing machine then shown. The trials were postponed for some years, and at the second contest in 1880, no less than twenty-three competitors presented themselves. The ruling idea was a crushing machine. Exhibitors from England, America, France, Denmark, Hungary, Java, New Zealand, and India were represented, but in no case could a machine be found that would "extract the fibre from the brown exterior pellicle and from the excess of agglumenative gummy matter which holds them together in such a manner as to produce an article whose value in London shall not be less than £45, and of which the cost of production shall not exceed £15 per ton of fibre obtained." Crushed stems, in fact, no matter how deftly treated by mechanical means, refuse to surrender their more delicate filaments (and these are the most prized), and only give up their coarser constituents, in a more or less mangled form, when subjected to the clumsy ordeal they have undergone. All at once, and that not so very long ago, the chemists who had been investigating the progressive action of fermentation in plants in cold and warm water, obtained a clue to the laws which seem to regulate the process of vegetable decomposition, and did not fail to observe that as the temperature was raised, the adherence of the internal ligneous part and the cortical envelope is destroyed, and the separation of each of the different concentric layers which form the wrapper, is effected. The fibre-bearing plant is provided with three zones in the bark, consisting of the epidermis and a thick layer of parenchyma, which contains the chlorophyllum of the plant, then a larger layer of cortical fibres, generally isolated and independent of each other; the last zone is contiguous to the cambium in which are the finer fibres and associated with these there is an abundance of small crystals of carbonate of lime; it was found, that if the stems were subjected to superheated steam or some such calorific agent, the moisture could be drawn off effectually in a few minutes by the addition of some chemical re-agent, and the fibres extracted free from any kind of adhesive particles that would render it unsaleable, there was an end to all obnoxious or tedious "retting" or "stripping" processes and the object of their search was attained. During the last four years steady progress has been made in rendering the operation perfect and profitable, and at a cost which will be hardly felt when the value of the fibre comes to be submitted to the manufacturer; similar experiments have been made in England, France, and America. The work commenced in France by the well-known M. A. Favier has been improved upon by the distinguished chemist M. Fremy. In England much attention has been bestowed upon the subject, whilst American chemists have contributed their share. Side by side with these discoveries of such incalculable

value to the commerce of the future, chemists in the north of Europe, in America, France, and England, were making equally rapid progress in perfecting new methods of extracting saccharine matter from sugar-cane, sorghum and maize plants. The old and cumbrous process of extracting sugar from cane by elaborate and costly machinery, always most profitable to the manufacturer, but which after all gave only a poor return to the grower, had this effect amongst others, ... the production of beet-root and other kindred saccharine plants upon the market in competition with our colonial trade, was admitted on all hands to be defective and unprofitable. Other means have now been found by which pure sugar and syrup can be drawn direct from the sugar-producing plants we have indicated. By this new departure costly machinery is dispensed with, and the land in some instances, without overtaxing its power of production, can be made to give a continuous yield of sugar-producing plants. Crushed cane with its poor return in sugar, molasses, and treacle will become things of the past. The American Department of Agriculture, ably supported by chemists of known experience, have superintended for the last four years the new method of extracting sugar by a simple chemical operation, and at a cost which, including the cultivation of the plants, at first sight may seem simply incredible, until the tables of expenditure and profit are consulted, when all doubts are dispelled by the evidence they contribute. It appears by the published report of the United States Department of Agriculture at Washington that—"Eighty batches of syrup taken by the manager from the finisher in the consecutive order of production made from cane and stems of all conditions, good, bad, and indifferent, show an average of 66 per cent of crystallized sugar. Several of the best show as high as 80 per cent. All would have shown this high average if all the cane had been good." In England like results have been arrived at as we have already shown in the pages of this journal, and it is possible when the researches now under observation and exhaustive trial have been perfected, as they assuredly will be before long, that a perfect revolution in sugar production will be effected. Nor has the investigation of methods for extracting these products by chemical means limited the field of operation; these same chemical studies have led to others of equally high commercial importance. The same or equally simple methods will be applied to the extraction of dye stuffs and other alkaloids with apparatus, which, we gather, is of the simplest and most inexpensive character.

SUGAR MAKING AT CHAMPAIGN, ILLINOIS.

THE marked success that last year attended the production of sugar from the sorghum canes at Champaign, Ill., and Rio Grande, N. J., awakened a deep and wide spread interest throughout the country. It seemed to give promise of such an ultimate development of this industry as would free us from dependence upon foreign sources of supply which now furnish nine-tenths of the sweets consumed in this country, and cost us annually in first cost and duties paid upon the same, nearly $150,000,000. While for some years the quality of syrups from sorghum, under improved methods of manufacture, have steadily improved till many manufacturers now furnish syrups of excellent quality, and while from time to time quantities of sugar have been produced from the unexpected and unwished for granulation of syrups, no direct efforts at sugar production can be claimed to have been successful and profitable till those of last year at Champaign and Rio Grande. While the juices of the sorghum canes, as shown by analysis, were known to be rich in true cane sugar, the practical difficulty has been to obtain it in a crystallized form, and in paying quantity. There were hindrances to crystallization not till recently understood, nor the methods for overcoming them. But since the work was so successfully carried on last year at the above named points, and both companies are now, together with several new ones in different parts of the country, engaged in successful sugar production from this season's crop of cane, it can, we think, be safely claimed that sugar production from sorghum is now established as a sure, certain and profitable manufacturing industry, which offers as profitable employment for capital as any other manufacturing industry in the country. A recent visit to the works of the Champaign Sugar Manufacturing Company, enables the writer to give to the readers of the *Farmer's Review* many facts of interest in regard to this season's work. The company has this year 615 acres of cane, while last year it had but about 250. Its quality is better than last year, August and September furnishing a great deal of sunshine, which is needed to develop the sugar in the juices of the growing and ripening cane. Some fields of cane have been frosted so as to make it unprofitable to work for sugar, but without materially injuring it for syrup. But the most of the crop is in good condition for sugar making. About 100 acres of the cane was grown by the company, the balance by farmers on contract, the company paying $2.50 per ton for cane delivered at the mill, topped but not stripped. The average yield is about 9 tons per acre. A good deal of improvement has been made in the machinery of the works since last season. Then there was a deficiency in boiler capacity, in charcoal filters, in defecating capacity, and in centrifugals, so that while the mill could grind 150 tons of cane per day and the vacuum pan finish the juice into sugar, they were enabled to run only about 50 tons per day. Now they run about 150 tons every twenty-four hours, the deficiencies that existed last year having been fully supplied. They use a double-[illegible] (No. 1 Cuba flexible). The rolls, three to each set, are 4 feet in length by 30 inches in diameter. The power is so ample that with cane fed solidly from four to six inches deep, there is no clogging or check to the motion, which is 22 feet per minute. The second set of rolls is about 12 feet beyond the first, a carrier taking the partly pressed cane from the first to the second. On its passage it is moistened by jets of hot water from a perforated horizontal pipe some two feet above the carrier. The second pressure is immense. The bagasse mostly comes through entirely separated at the joints.

What is not so separated is thrown back, to come through again, by a boy stationed at the tail end of the second set of rolls. The company claim that by the use of this second set they save at least fifteen per cent of juice that would be lost if only a single mill was used. Last year the firing under the boilers was by coal alone, and men and teams were employed to cart the bagasse away to get rid of it. Now it is all used as fuel, and supplies two-thirds of all the fuel required, taking the place of fifteen tons of coal per day. It is carried by the bagasse carrier over the front end of the furnaces, and by an ingenious arrangement of slides, fed directly into shafts running down into each of the four furnaces. No handling of it is required, only the manipulation of the slides by cords and pulleys so that each of the four furnaces shall be alternately fed. There is no trouble in keeping the steam up to any desired pressure, and the saving in fuel and labor from this use of the bagasse cannot fall much short of $60 every twenty-four hours. The juice from the mills flows into a tank from which it is pumped into the juice tank at the extreme top of the building. Here it is treated to lime to neutralize the acid and then drawn off to the defecating tanks, a half story below. These are of galvanized iron in wooden frames and supplied with steam coils. The juice is brought quickly to a boil and the scum taken off. This flows through pipes to a tank on the ground outside the building and is taken away for feeding hogs. The defecated juice next passes to the evaporator of copper, circular, eight feet in diameter and three feet deep, the bottom covered with two inch copper coils. Here it is reduced to 20° Baume, when it is drawn off into settling tanks. When sufficiently cooled it passes to the bone-black filters, up-right cylinders of boiler iron, 18 feet in depth and filled with finely pulverized bone charcoal. From the bottom of the filters the clear, amber-colored, semi-syrup flows into a tank from which it is pumped to reservoirs above the vacuum pan, into which it is drawn as needed. In boiling in the vacuum pan a small amount only is first let in and boiled at a temperature of 170°, till crystals can be seen to be forming freely. This can be ascertained by drawing out a small amount, spreading it upon glass and holding it between the observer and the light, when the crystals can be clearly seen. Additional quantities of the semi-syrup are let in from time to time until at the end of about five hours the pan is full of the boiling sugar, when the *strike* is made. The contents of the pan are discharged into crystallizing wagons—tanks of boiler iron five feet long, three wide and two deep, on iron trucks. These are wheeled into the crystallizing room, which is kept at a temperature of 90 degrees, where the crystallization is perfected. When ready for the centrifugals the wagons are run out and their contents dumped into the mixer, a long horizontal trough, in which a horizontal shaft with wooden arms revolves, which thoroughly mixes the mush sugar. From this it is drawn directly into the centrifugals on the floor below. These are perforated brass cylinders suspended at the end of a perpendicular shaft, which makes 1,200 revolutions per minute. The perforated brass cylinders revolve inside of stationary iron ones. As soon as started the centrifugal force throws the mush sugar against the inside of the perforated brass. The molasses is thrown out through the perforations, while the crystals are retained inside. The molasses is retained by the outside stationary cylinder, and runs off to tanks through a pipe in the bottom. When sufficiently purged the machine is stopped, the sugar adhering to the inside of the brass cylinder is scraped off and discharged from the bottom into a box below, from which it is barrelled, and is then ready for market. The sugar thus obtained is called *firsts*. The molasses is afterward reboiled for sugar, and yields in seconds about one-quarter the quantity of the firsts. The sugar grades from Yellow C to off A, and finds ready sale at an average of 7 cents per pound wholesale. The molasses remaining after working for seconds is refined, making an article of table syrup, which sells at 40 cents per gallon wholesale, though this price was shaded a little on some lots last season.—*Farmer's Review.*

AGRI-HORTICULTURAL SOCIETIES.

IN the Resolution of the 17th September 1879, it was decided that as grants-in-aid to agri-horticultural societies had been made a charge on provincial funds, the control over such grants should be transferred to local Governments. At the same time it was suggested that donations from the public funds should be governed by certain fixed principles, such as the extent to which the operations of the societies promote objects of public benefit, and the amount of the income derived by them from independent sources. The Government of India also desired to be furnished once every three years, with a progress report, showing the work accomplished by each society, and the help afforded from provincial funds.

The first triennial reports have now been received, and afford the following information. There are, or rather were, agri-horticultural societies at Calcutta, Madras, Lahore, Nagpore, and Rangoon; those at Lahore and Nagpore have, under recent arrangements made by the local Governments, received a new organisation under which they will no longer be known by their former title.

The society at Lahore had long been on the decline owing to a variety of causes. The great difficulty of securing a permanent Honorary Secretary, with sufficient leisure to devote to the proper working of the society, and the greater advantages and facilities afforded to contributors of information by the periodical press of late years, had with other things combined to create a lack of interest in its members. The original objects of the society were imperfectly carried out, and its gardens had gradually assumed the character of a mere agency for supplying seeds and plants.

The condition at which the society had arrived is clearly set forth in a joint report submitted in March last by Major Wace, Commissioner of Settlements and Agriculture, and Mr. Baden-Powell, the Honorary Secretary. On the recommendation of these officers, the Government of the Punjab has decided that the institution shall in future be known as the Government Agri-horticultural Gardens, Lahore, and managed by a committee composed of *ex-officio* and nominated members. The present grant of Rs. 9,000 per annum is to be continued, but its expenditure will be subjected to the control of the Commissioner of Agriculture. Subscriptions will be received as heretofore, but subscribers will not be entitled to more than the full value of their subscriptions in seeds and plants. With the object of securing scientific supervision and advice, it is further intended that with the permission of the Government of the North-Western Provinces and Oudh, the Superintendent of the Botanical Gardens at Saharunpore should inspect the Lahore gardens at stated periods every year. The school for the training of gardeners now attached to the gardens is to be maintained and improved.

The Nagpore Society was maintained principally by annual grants from local and provincial funds. In 1881-82 these amounted to Rs. 4,000, against Rs. 373 realised from subscriptions, Rs. 2,700 from sale of produce, Rs. 600 from miscellaneous sources, and Rs. 500 paid by the municipality. The work of the society lay for the most part in the distribution of plants and seeds, of which but a small proportion were new or exotic varieties. No attempt had been made to collect botanical specimens; no proper record appears to have been kept of the results attained in the experimental cultivation of fruit trees, grasses, &c., and the efforts made to disseminate information have been very limited.

Under these circumstances the Chief Commissioner has decided to formally make the gardens a Government institution, which, practically speaking, they have always been, and to place them under the Provincial Department of Agriculture. The existing grants are to be maintained, and the functions of the society will continue to be exercised by the institution which will take its place. It is hoped by this arrangement to secure continuity of work, which has hitherto been impracticable owing to constant changes in the honorary secretaryship of the society, and to bring the institution into closer relation with the district gardens which exist at every head-quarter station.

Among the remaining societies at Calcutta, Madras, and Rangoon, first in order of importance stands the society at Calcutta, whose operations extend to the whole of India. This society receives a grant-in-aid from Government of Rs. 2,400 per annum. The remainder of its total income of Rs. 35,000 consists of Rs. 16,000 received from subscribers and Rs. 17,100 from sales of produce. In 1883 the society numbered 595 members, some of whom are residents of foreign countries. Its work comprises the distribution of plants and seeds to members and the public, the trial and distribution of various indigenous and exotic products, and the rearing of useful plants. The society interchanges plants and seeds with similar bodies in the British colonies and the other provinces of India, and carries on a considerable correspondence regarding the introduction of new staples, field crops, &c. It also publishes a monthly journal of its proceedings, embodying the botanical and agricultural information collected from time to time. Of the subscriptions received from members, the greater part is said to be returned to them in the annual distribution of vegetable and flower seeds, fruit, grafts, publications, &c., and the Secretary represents that an increase of the grant-in-aid from Government would enable it to perform a larger amount of useful work for the public at large.

The assistance received from Government by the society at Madras amounts to Rs. 3,000 per annum, besides a special grant of Rs. 500 for prizes for useful products. The rest of its income is made up of from Rs. 8,000 to Rs. 10,000 realised from sale of seeds, plants, &c., and between Rs. 2,000 and Rs. 2,500 from subscriptions. A proposal is under the consideration of the local Government to increase the annual grant of Rs. 3,500 to Rs. 4,000 in view of the work done by the society. This consists in introducing, acclimatising, and distributing plants of known economic value, in making known improved agricultural implements, and in engaging and training gardeners for employment in India and Burmah. Like the Calcutta Society, it publishes periodical reports and any information contributed by its members. It also maintains valuable and extensive botanical gardens, which have recently been enlarged, and afford much interest and instruction to the scientific public and students of various botanical classes. An annual show held by the society is much appreciated by the native public, and serves to interest them in the objects which the association has at heart.

Owing to the smallness of the European community, and the difficulty in obtaining native co-operation, the society at Rangoon has hitherto led a precarious existence. It is almost wholly supported by donations from public funds, *viz.*, Rs. 1,200 per annum from provincial revenues and a similar contribution from the municipality. Rs. 1,600 are obtained from sales of garden produce and some Rs. 700 from members. The objects of the society are the same as those of its contemporaries at Calcutta and Madras, though necessarily conducted on a smaller scale. Efforts are said to have been made in 1881 to induce some Burmese gentlemen to join it as members, and with some small success. In the same year the first step was taken by the Provincial Administration to utilise the society's agency for the promotion of agriculture, by prevailing on the latter to set apart a selected area of the garden for experimental cultivation of crops in which the Agricultural Department is specially interested.

It appears to the Governor-General in Council that, under the circumstances referred to above, the Governments of the Punjab and Central Provinces have acted advisedly in placing the horticultural gardens at Lahore and Nagpore under the cultural Departments in those provinces. Experience has shown that the communities at those stations possess neither the leisure nor the opportunities and facilities for an effective performance of the duties, which the objects of such societies impose upon their working members. Whilst, therefore, acknowledging the zeal and devotion with which the members of the associations in question have carried out their self-imposed task, the Governor-General agrees with the local Governments that the interests of the gardens will be promoted by the new arrangements which will furnish that continuity of management and direction from the want of which they have hitherto suffered.

Of the great utility of the institutions at Calcutta and Madras there can be no question. At the same time it appears to the Government of India, that the agency afforded by these societies might be more largely utilised by local Governments for the distribution of information, seeds, and plants; for the experimental cultivation of crops; and for various other objects. Where Agricultural Departments exist, the societies might usefully co-operate with them, and the Government grant may appropriately be regulated in view of such co-operation. It seems desirable therefore that in future reports the opinion of the officers in charge of the Agricultural Departments, as to the utility of the societies to the general public, should be recorded. The Government views with favor every endeavour made to enlist the interest and assistance of natives and of agriculturists generally in this work. In this way the value of the societies to the country at large can be greatly increased, and their labors bear permanent fruit. In Rangoon it is observed that these suggestions have to some extent been anticipated, and the Government of India hopes that, working as it does in a comparatively new field and in enjoying other advantages, the society at that station will by the end of the next three years show that it has made full use of its opportunities, and attained an increased measure of usefulness.

THE THEORY OF THE POTATO DISEASE.

RECENTLY in connection with the North of Scotland Horticultural Association at Aberdeen, Mr. Stephen Wilson, of Kinmundy, Aberdeenshire, read an able paper on the above subject. Mr. Wilson proceeded as follows:—There are various diseases which affect various parts of the potato plant; but the disease which is produced by the fungus called *Peronospòra infestans* is more especially known as the potato disease: and it is to the theory of this disease that I am to direct your attention. The word 'theory' has sometimes one meaning and sometimes another; what it means here is simply the method or course by which the fungus produces disease in the potato. It will not be possible to go minutely into all parts of the subject, but as I assume to have made a discovery which throws some light upon the true theory, a word or two must first be said on certain points of existing theories of the disease. I scarcely think it is necessary in this part of the country to enter upon any proof that the potato disease is caused by a fungus. Mr. W. G. Smith says in his evidence before the Potato Committee—'Not one potato grower in a hundred knows anything about the exact nature of the potato murrain; the majority of farmers do not know whether the disease is an insect, a fungus, or a gas; whether it is caused by a fog, rain, or a thunder-storm; what it is, whence it comes, or where it goes, they have no idea.' But we shall assume that a knowledge is possessed that the disease is caused by the *Peronospora infestans*. And I think it is of great importance to a clear understanding of our subject that the disease in the tissues and substances of the potato plant should be conceived of quite distinctly from the fungus which produces this disease. The disease is not the fungus, and the fungus is not the disease. If you drive a piece of red-hot iron into your hand, or if you swallow arsenic, disease or disorganization will arise in certain tissues or fluids of your body, but the poison and the iron are not the disease, but the cause of it. And if the peronospora is the cause of disease in the tissues and fluids of the potato, the question arises, how does it get into these fluids and tissues? A friend of mine, Mr. Thoms, of Alyth, who has given considerable attention to the potato disease, is of opinion that the peronospora arises from pathologically altered cells of the potato itself. But whatever may come out of this view, I do not think that as yet there is sufficient proof of a theory so startling. The views of De Bary, which command a large amount of acquiescence, may be most readily collected from the Potato Blue-book. Mr. Thiselton Dyer explains these views. He says—'As long as the potato has been in cultivation, I do not know whether there is any evidence that it has ever been free from the potato disease. It is stated by Boussingault, the French chemist, who has lived in South America, that in Western South America, which is the native home of the potato plant, it always is diseased, more or less. And one of the most important points in Mr. Dyer's evidence is the assertion that he has no doubt that the potato tubes carry on the mycelium of the fungus from one year to another. And the way in which he thinks this mycelium in the tubers reproduces the fungus is, that it makes its way up the haulm, probably in some cases growing with the shoots. As the shoots grow up they are always diseased from their infancy onwards, till at last, when the plant is mature, spores are produced and are distributed; and, he adds, there are some facts which tend to show that the mature foliage of the potato lends itself more readily to the attacks of the disease than the young and growing foliage. Then, when [illegible] first spores, or conidia, have been produced, it is held that they [illegible] dispersed by the wind, and alighting on other leaves, send the tubes [illegible] 300 spores into them, and so spread the fungus and the disease over the whole crop. But it is also held that the fungus not only devastates the foliage, but finds its way down the haulm to the tubers, these being only a modification of the haulm, and

in direct communication with it. These seem to be the more essential points in the theory of De Bary. You see that it affords no explanation at all as to how the fungus first or at any time obtains an entrance into the host plant. If mycelium is lodged in one seed tuber during winter, and works its way up to the foliage, and thus produces disease in a given plant, why does the same principle not apply to all the other plants in a field? One plant is diseased by the action of hybernating mycelium, and another by the action of zoospores. If the first cause is sufficient to produce disease, why introduce the second? The theory of Mr. Worthington G. Smith differs somewhat from that of De Bary. The fungus in De Bary's theory can hardly be said to have an existence apart from the host plant; it is a parasite all the year round. If it is not producing disease in the plant in autumn, it is lying asleep in the tubers, or at least in some of them. But in Mr. Smith's theory the fungus is not a parasite all the year round; part of its life is non-parasitic, and may be passed within the soil, or upon any substance indifferently. The same mycelium which produces the conidiophores is also held to produce resting spores or oospores, which fall down upon the ground with the dead leaves and branches, and lie in a resting condition till next autumn. 'When these eggs at length burst,' says Mr. Smith, 'they generally protrude threads which carry seeds or spores, and those seeds are set free in uncountable millions. These seeds sail through the air, and such as fall upon potato plants rapidly gain an entrance to the interior tissues of the host and cause its corrosion and destruction. No doubt,' he continues, 'living resting spores, together with fungus spawn, are often planted with potatoes, and when this is the case the disease commences with the tuber and works upward; whilst in the former case, *i.e.*, when the germination of the resting spores takes place upon the neighbouring ground, the leaves are the first parts attacked from the air, and the disease works downward to the tuber. It is also a part of Mr. Smith's contention that when the disease is begun by resting spores, it is carried on and augmented by conidia. In this theory, as well as in that of De Bary, you see that there are two principles on which the fungus produces disease in the potato; the action of resting spores and the action of conidia. Both theories make use of the conidia when once they get them. Now it may be asked, if the resting spores, lying as mere non-parasitic fungi upon the ground, can germinate and produce spores, which are the perfect fruit of fungi, what can the peronospora want with the potato? The potato is doing it no harm, and apparently can do it no good; it has perfected its fruit before reaching the potato, so that its attack on the potato seems a piece of pure mischief. But if the spores or conidia produced on the mycelial threads arising directly from resting spores hybernating on the ground, are sufficient to set up disease in a certain number of leaves, why are they held to be insufficient to produce all the disease? One main defect of these theories seems to me to be that they want a philosophy. You do not see that any rational purpose is served by the introduction of the parasite into the host plant. Now, the antecedent probability is certainly very great, that in the case of all parasites, the entrance into a host plant is for some important biological purpose. Many minute fungi, such as *penecillium*, live and perfect themselves by producing reproductive spores or fruit on dead material without entering into living tissues and becoming parasites. And if the *Peronospora infestans*, and many others, could perfect themselves on dead material, there would be no occasion why they should become parasites. But if this *Peronospora* cannot produce its spores or conidia or fruit except by becoming a parasite and feeding upon the substance of a living plant, then we begin to see that there is a philosophy in the potato disease, and that although mischief may result, yet the essential purpose of the parasitism is that the full developement of the parasite may be accomplished. The question then comes to be—In what form and in what manner does the *Peronospora* enter into any part of the potato plant? In the last paper which I read to this society on the club-root fungus (*Plasmodiophora brassicæ*), I endeavoured to show that the germinal form in which the fungus is absorbed by the roots of turnips and other cruciferous plants is a granular plasm. And the purpose, so to speak, for which this fungus enters the host plant is that its spores or reproductive elements may be perfected. If it did not enter the host plant it could not reach its full development. Again, in the case of smut, which in some years destroys perhaps five per cent of the oats, especially after turnips, the fungus does not attack the ears from the atmosphere in any form whatever. If you will examine the progress of this fungus, and the disease of the ears consequent upon it, you will find the fungus in its rudimentary stages long before the ears are out of the sheath, or have attained to a length of one-tenth of an inch. And going a little further you may come upon an oat plant, or a barley plant, having six or eight stalks on one stool, and if you find that one ear is smutted, you may predict almost with certainty that the ears of all the stalks are smutted. Now, it is impossible to suppose that this could be the case if the elements of the fungus came through the atmosphere. These elements come in from the soil. The myceliating spores are lying in the soil, but they cannot reproduce perfect smut in the soil; they must in some form enter a host plant, and go through a process of gestation. I may say here that this fungus does not enter the corn plants by the ears, or by the leaves, or by the roots; it enters by the cotyledon or scutellum, which is the organ that absorbs the dissolving body of the grain connected with the seed, and the fungus enters the embryo, mixed up with its proper food, in the [illegible]ular plasm. I have frequently seen this plasm, and the mycelium which produces it, in the early stages of the germination of the corn plants; and the phenomenon affords the only explanation of the smutting of all the ears upon a stool. Frequently, however, when the attack of smut is severe, several of the tillers on a stool are killed at an early stage, and never go the length of producing ears at all. The rusts enter the structure of the corn plants in exactly the same manner as the smut. They are introduced into the germinating embryo in the form of a plasm by the absorptive action of the cotyledon as it draws in the dissolving food of the young plant. Now, accepting these statements for facts, it will be no matter for surprise if we shall find that the elements of the *Peronospora infestans* in a rudimentary form enter some part of the potato plant from the soil, and not from the atmosphere. If the club-root fungus enters the turnip in the form of a granular plasm, and goes through a process of growth for the very purpose of perfecting its spores, why may not the potato fungus act upon the same principle? Well, it was from some of these considerations that I was led to examine perfectly fresh potato tubers, perfectly fresh stalks, and perfectly fresh leaves in all stages of their growth; and in all these parts, as well as in plums or fruits, I have found certain small organisms which are distinctly not of the potato tissues, but easily separable from them by dissection. I gave the name of sclerotials to these bodies, implying thereby that they are small sclerotia. A fungal sclerotium is in general a solid leathery or horny mass of excessively branching mycelium, all felted together by the fluid which exudes from it. The ergots on many of the grasses are most familiar examples of sclerotia; but there are many other sclerotia besides ergots. They are all the resting or hybernating states of certain fungi. They lie dormant through the winter, and germinate at various periods of the following summer and autumn, producing their appropriate fungi, the spores of which again produce the mycelia from which grow the sclerotia show specimens, and so the life-circle is completed. Now, supposing that these sclerotials, which are in most cases so abundant in the tissues of the potato plant, possess the functions of sclerotia, the circumstance will be in perfect harmony with that department of fungal life which has just been alluded to. These sclerotials, however, are parasitic; they exist in the tissues of the living plant. They are most perfectly developed in the leaves, and are situated about the middle of the leaf, and over its whole extent. Seen by reflected light they are quite white, but they are most conspicuous by transmitted light, and then, as they are opaque, they appear nearly black. In the leaves they are about the two-thousandth of an inch in diameter, and are of various rounded forms, like long potatoes, or like round potatoes. They consist of a mass of variously-shaped granules, held together by some kind of gum. Sometimes a delicate bit of mycelium may be seen in them, but in general they consist merely of agglutinated granules. In the stalks of the potato they are of much larger size, but are of a looser texture and less definite form. In the tubers again they are of many different sizes. Some of them are rounded and compact, some of them are irregular in shape and very loosely aggregated together, and in some cases little clusters of those opaque granules lie about amongst the starch cells, with little or no mutual cohesion. They are situated in the greatest numbers round the eyes and round the insertion of the stalk on which the tuber is attached, and from which it grows. Now, I make no demand upon your faith in regard to the presence of the sclerotials; they are startingly visible in the preparations put before you, and have been admitted by all who have seen them. But I must ask you on this occasion to believe that the granular plasm from which these bodies are developed, first enters the potato by the young tubers from the mycelium of resting spores in the soil just in the same way as the plasm of the club-root fungus enters the turnip bulb. Well, we have thus got potato tubers infested with fungal sclerotials and looser masses of the same granular particles. These are all visible in the tubers, and must have entered in some way or other. We see them in perfectly fresh tubers, but in such tubers we see nothing of De Bary's hybernating mycelium; nevertheless, these granular bodies are exactly equivalent to such mycelium. But it does not at all follow because these bodies are present in the tubers that they should germinate at any time and produce disease; sclerotia germinates only at certain periods of the year. And so long as these bodies remain quiescent in the potato tubers, they do no harm any more than the crystals found in the tissues of many other plants. Well, the infested tuber is cut into sets and planted. And as the haulm and leaves which result from germination and growth, are mere developments of the tissues of the tuber, the granular fungal matter in the seed tuber is carried up and distributed through the stems and leaves of the plant; and in these accordingly, at all periods of the season, it is found developed into the sclerotials. If those who follow De Bary contend that the hybernating mycelium is carried up with the growing shoots, they can have no difficulty in admitting the translocation of the sclerotic granules. We have only to wait now and see what will become of the little particles lying within the leaves and stalks. A leaf may sometimes be found containing few or no organisms; but in most leaves they exist in great numbers. And certainly it is not to be denied that if they germinate and give rise to the mycelium, which runs through the leaves and produces the conidrophores of the peronospora, they are exactly in the position which they should occupy. The upper side of the leaf consists of closely perched palisade cells, while the lower side consists of loose round cells. The sclerotials become developed at the base of the palisade cells. The autumn is now approaching, and you go out some dewy morning, and observe a few black spots on your potato leaves. You take one of those leaves for inspection. You discover very soon that nothing is to be made of the tissue, which is already black; everything is too opaque. But round the black spot you find that there is a peculiar green border, as if that part of the leaf had been squeezed. Teasing out a part of this border, you find that it is permeated in all directions with very irregular lines of mycelium, and that these lines are here and there sending extensions out at the stomata of the lower side of the leaf. You follow these extensions, and you find that they are the stalks which bear the conidia of *peronospora infestans*. This part is easy, and completely satisfactory. But you want to find where the mycelium inside

the leaf takes its rise. Has a zoospore come flying through the air and entered the leaf, or has one or more of the little sclerotials, already inside, simply germinated? I don't wish to make you more certain than I am myself; this question is excessively difficult to answer. The leaf mycelium is of great transparency, and although it gradually attains a considerable diameter and is easily seen, yet at its origin it is of extreme fineness, and unless separated from the tissue of the leaf, cannot be seen at all; while the operation of separating it from the tissue breaks away the threads from their origin, whatever that may be. Nevertheless, in the course of the last three years I have come upon what I regard as sufficient evidence that the mycelium in the leaf and other parts results from the germination of the sclerotials. The granules at the boundaries of these bodies become detached, and throw out lines, which at first are only to be seen with a high power in the most favourable light. Of course you see at once that by this theory every leaf in a field contains the materials producing its own disease. In every infested leaf there are hundreds of more sclerotials that would destroy it. No flying zoospores are here required. The enemy has been lodged inside all the season. And the philosophy of its germination is, that the parasite may be brought to its perfect fruit-bearing condition. In the early period of the disease only one or two spots may arise on a leaf, showing that only one or two centres have germinated; but later on, the sclerotials germinate in all directions over a leaf, and produce little black spots, which gradually run into each other. It is a mistake to say that the disease does not arise till the leaves are turning yellow; the growth of the fungus is most rapid in leaves perfectly green. By this theory you see that no journey of mycelium down the stalks or up the stalks is necessary for the destruction of the stalks. Any one who has closely observed must have seen that a part of a stalk is often diseased while the parts above and below are perfectly fresh and green. This cannot be explained by itinerant mycelium. But it is easily explained on this theory; the sclerotials have germinated where the disease appears, and have not yet germinated above and below. If you make a thin slice of a stalk, and place it during night in moist air, the sclerotic masses will germinate, and in the morning you will have a forest of peronospora, the plants all standing with their fruits on the branches. In the same way with the tubers, a thin slice laid upon a slide will throw up a thicket of conidia-bearers, with the denser growths arising near where the sclerotia are situated. The plums are also liable to be infected with these parasitic granules. They appear first, of course, in the ovary around the seeds and scattered through the walls. So that in autumn you have only to place a few plums in moist air to get a crop of peronospora bursting through the surface, or a thin slice may be placed on a slide, and the fungus will in a few hours be in full fruit. Thus, then, you have a brief outline of the theory or course which the parasite pursues while it is within the tissues of the host plant. The germinal granules are absorbed by the underground stalks, and thus enter the tubers; and on the germination and expansion of the tissues of the tubers, they are carried out with the expanding haulms and foliage. In these they lie, possibly undergoing some secret process of preparation or gestation, till the proper time for germination, when they start into activity, and by the assistance of the juices of the host plant used as food, the purpose of their parasitic life is accomplished in the production of their conidial fruit and seed. But you will naturally ask, what becomes of the fruit and seed? Other theories find a use for the conidia in the spread of the current disease. Here the whole of the current disease has one source, namely, the germination of the granules within the tissues; so that the conidia are no more required for the current crop of peronospora than are the seeds shaken out of a crop of wheat for the current crop of wheat. It would take too much time to go into that part of the life of the fungus which is passed outside of the potato; therefore, I may say, shortly, that when the conidia fall to the ground, they germinate in various ways and give rise to the resting spores or oospores. These grow at any time through the winter, and produce a strong, jointed, brown mycelium. And it is from the granular plasm carried through the soil by this mycelium that the elements of the fungus are again brought into contact with the young tubers of the po ato. It is easy to prove that the conidia give rise to the resting spores. If you take half-a-dozen potato leaves on which the disease has begun, and place them against the inside of a bowl, and then invert the bowl on a plate, and pour in a little water to keep the air moist, in the course of six weeks or two months all the conidia will have disappeared, while the leaves which showed no oospores at the beginning will be found swarming with them in great beauty. Thus the life-circle of the *Peronospora infestans* becomes completed. It could not become completed unless the fungus became a parasite. And I will venture to add that the theory thus imperfectly submitted to you affords a more satisfactory explanation of the phenomenon of the potato disease than any other which has been proposed.

Mr. Wilson, replying to the remarks of several speakers, said: It has been asked why the disease generally first appeared in the leaf. It seemed to be a characteristic of the fungus that it germinated sooner in the leaves owing to their constitution and the constitution of the fungus particles. The theory he had advanced regarding the spread of the disease explained why some of the new varieties of potatoes resisted the disease better than the other theories he had referred to, the explanation being that year after year the potatoes became more charged with the sclerotials. When the tubers got a certain amount of this material into their tissues one year, it was carried on in the young tubers and an addition was made from the soil at the same time, so that by and by, in the course of years, all the potatoes became charged with the germs of the fungus, and would not grow. It appeared that there was something in the constitution of the champion variety of potato which prevented the germination of the disease. Its roots penetrated deeper than some other varieties, and it was a late potato, and did not come to maturity at the period at which the disease was most liable to appear. It did not ripen until the season had become colder and more unfavourable for the germination of these bodies. That seems to be partly an explanation of the way the champion had more or less resisted the disease.

Mr. Robson asked if Mr. Wilson suggested that by planting diseased tubers they would specially propagate the disease.

Mr. Wilson said the meaning of it was simply that nearly all the tubers at the present day contain matter from which the fungus is produced, so that they found it impossible to plant undiseased potatoes, though the disease was not developed. He did not find that by raising potatoes from seedlings they would escape the disease. Speaking of the Jensen system, he did not believe it was a proof against disease. If they earthed up potatoes and put them further from the light and air, it was perfectly evident that no seed would germinate—it could not germinate except under proper atmospheric conditions. The Jensen system might be a method of diminishing the disease, although his theory might not be correct. The potatoes were put into the soil under new conditions, and the question was, 'Were these new conditions the cause which retarded the germination of the fungus or not?' He thought that might be the real explanation.

WIREWORM AND ITS REMEDIES.

MISS E. ORMEROD, Special Lecturer on Economic Entomology at the College, and Consulting Entomologist to the Royal Agricultural Society, recently delivered a lecture on wireworm to the students of the Royal Agricultural College, Cirencester. The lifetime of the grub, she said, extends over as much as five years, and during this time it feeds in winter as well as in summer, unless the cold is so severe as to cause torpidity, and (with the exception of mustard) it appears to feed on the roots, or underground portion of the leafage, of almost all kinds of common farm crops which may be successively put into the ground. After describing the 'click beetles' which lay the eggs of the wireworm, Miss Ormerod proceeded:—We all know the appearance of the common wireworm by its resemblance to a short piece of flattened wire, or of straw, which it resembles in colour, but some kinds found in decayed leaves or wood are of a deep pitchy brown. All of them have three pairs of little claw legs, and also jaws which they use only too readily. Where wireworm is numerous in wheat or any other growing crop, if this crop is in good heart, or as was often the case last year (1882), if the weather is favourable, we may very possibly escape much damage. Or sometimes we may lessen the amount of injury that is going on by various measures, such as compressing the soil so as to prevent the wireworms travelling through the ground, or using applications which will attract the worm or drive it away, and so give the plant a temporary respite, or which will act as temporary fertilizers. Still, these special measures require special outlay, and it is a much better plan as far as we possibly can to forestall attack; and as wireworm is generally to be found in land broken up from old pastures, clover leys, or sainfoin, the treatment of these, both before and after breaking up, so as to lessen the amount of egg-laying and also to diminish the numbers of the wireworms (which otherwise would have infested each successive crop for years), is an important item in prevention. If we look first at the treatment recommended before breaking up grass or pasture land, or for reducing the ground into proper condition for the succeeding crop, we find the points aimed at are to make the surface quite unattractive for egg-laying, and to starve out the wireworms. For this purpose it is found serviceable to feed sheep or cattle on the ground with cake, or other feeding stuff, 'so that each inch of ground shall be trodden and eaten bare.' In one locality this plan was carried out by penning such sheep as were to be fattened during the winter on the land. The sheep were fed with turnips, oats, and hay. The pen enclosed as much ground as could be thoroughly trodden by the animals in the course of a week, and was then moved forward, going on regularly from one side of the field to the other, the ploughs following regularly so as not to retard spring operations. In this way (or with any adaptation of the principle that may be more convenient) the surface is so completely cleared of grass and herbage, and also sodden and consolidated, or 'firmed,' as it is sometimes phrased, by the droppings and by the trampling of the animals, that the beetle eggs are either not laid on the unsuitable ground, or are for the most part destroyed, and the wireworms are lessened in number, or driven away by want of food and difficulty of travelling in the firm or poisoned ground. Various chemical manures have been found useful for top dressing in the same way. Salt, at the rate of five to six cwt. per acre, has been serviceable in many cases, and applied in heavier dressings up to ten or twelve cwt. some weeks before sowing, it has served not only to diminish the numbers of the wireworm, but also to clear out the twitch or couch grass, which serve for a most favourite head-quarters of these insect vermin. Gas lime acts well at the rate of five cwt. the acre, or applied fresh and in larger quantities may be used as a regular killing dressing fairly to stamp out all surface life, insect and vegetable; and 'alkali waste' (where procurable) is a valuable application for the same purpose. In the neighbourhood of chemical works this material is to be had for little if any cost beyond that of carriage, and its strongly caustic properties make it a thoroughly valuable application for killing everything objectionable on which it can be brought to bear. In heavy dressing it destroys the deepest rooted weeds, such as thistles or coltsfoot, as well as couch grass, and fi[illegible]rmin fare no better in contact with it, and when its first work is over the process of oxidation turns it to a manure suitable to land on which gypsum is of use. The general plan followed by many agriculturists may be shortly stated to be this—to have the pastures eaten down as closely as possible, to break up the ground early in autumn, and

to collect and burn all grass, weeds, and roots, which might give shelter or food to eggs or wireworm; to thoroughly cultivate the land by ploughing, grubbing or otherwise, working well in to it lime (especially in a hot state) or lime and salt, or gas lime, or other application unfavourable to insect life. Also such manure and fertilisers should be applied on the land, or drilled with the seed, as will put the crop in good heart. Heavy rolling to compress the soil about the young plants is another important item. Everything alive or dead that can give shelter or food to the wireworm should be destroyed, and collecting and burning it is the most convenient method; but the burning should follow as promptly as possible on the collecting, or else the wireworm which were in the heaps, feeling themselves ill at ease in the unnatural locality, will have gone down into the ground out of reach of injury. The land being kept open by vegetable remains, bears on the question of wireworms being injurious after crops (like beans or field cabbage) of which the old stalks or some portion of the haulm are ploughed in, and gives an additional reason for prevalence after clover; and it leads further (though it appears very difficult to carry this point out practically) to whether the opinion may be perfectly correct which is held by some of our agriculturists, that the use of farmyard manure, in the state in which it is often worked into the land, *encourages* wireworm. From the information which we have gained of the common habits of the wireworm, and also of its customs when in emergency there appear to be full reasons for its general prevalence, and amongst these one special point is that the same general conditions which suit the growth of most of our crops suit also this destroyer of them. 'The rainy day is not the time for thatching'; and similarly, when the crop-pests are destroying the plant is *not* the right time for beginning to seek in all directions for how to destroy them—but to do it. In these cases the applications which we usually need are not so much the common plant food as a concentrated essence (so to call it) which we can procure at once, and which, by its rapid solution in rain or moisture, may be avilable for the plant *at once*; and also if posible, may *at once* make the locality so unpleasant to the grub or other insect that the crop may at least have a respite. These effects are more or less brought about by the application of mineral or chemical manures, and as preventives or remedies for wireworm attack there is a long list of them. Lime in its caustic state is always useful as a clearing dressing, and fresh gas lime, or alkali-waste, serves if need be to destroy all insect and weed life where it may be laid. Where alkali-waste is laid on in large amount, it washes down so readily that the drains will run milky at a depth of three feet in heavy land, and it may be to serve as an absolute purifier of all live vermin some way down in the land. We do not often need its application to this extent, but it is very desirable to bear in mind against the sudden appearance of some pest which should be fairly stamped out; and there is a material which for little if any more outlay than the cost of carriage will serve for this purpose, and, after a few months' exposure has neutralised its poisonous properties, will leave all land to which sulphate of lime is applicable all the better for the temporary heavy dressing. Salt given at the rate of 5 to 10 cwt. the acre is serviceable as a dressing before breaking of land, both for killing couch grass and driving out wireworms. Also the property that salt possesses of attracting moisture may be turned to good service on heavy corn land which is infested. The moistened surface becomes rightly incrusted (or firmed, as it is termed), and consequently the wireworms are to some degree prevented from travelling at will amongst the plants. Nitrate of soda pushes on a rapid growth, and is of great value as an antidote to wireworm attack in the straw crops, but little is said regarding the effect of this and salt being used together. Looking at the difficulty of the nitrate being often too stimulating to the growth of the straw and leafage, whilst the effect of the chloride (that is to say, of the common salt) is to prevent undue luxuriance, it would appear worth while to try the effect of the mixture. We thus should have a dressing which, without being too stimulating, would be a thorough fertiliser, and would also cause a condition of surface soil to some extent unsuitable for wireworm movement. Further, judging by the effect of both the nitrate and chloride on other larvæ, it might very likely prove so distasteful to the wireworm as at least to diminish the amount of attack. If we know that some common chemical likely to be tried has *no effect at all* on any given crop pest, this knowledge is valuable so far as it goes, for it saves the loss of time and capital in trying what its effect may be when the enemy is in the fields. But we greatly need to understand clearly and correctly in what way many dressings and applications which are known to be serviceable as preventiver in cases of attack act on the grubs or insects. Most grubs appear rather to die of starvation than to feed on what is not suitable; if we can manage to fairly imbue the soil with anything which in solution must necessarily be in some degree swallowed by the grub as it feeds on the roots in the dressed ground, we must benefit (also in some degree) by the application. We find that in some cases the grub sinks deeper and deeper in the ground to avoid the unwholesome presence, just as it does in the case of increasing frost; but as yet, as far as I am aware, we have no field experiment on these points. Every year the same loss of time and of material goes on in *trying*; as it is said, and whilst the trial is going forward the [illegible]op too often dies. If we had distinct experiments on the direct [illegible]fects on insect li[illegible]rate of soda, kainit, guano—which is said [illegible]r not I do not know) to destroy some larvæ, and [illegible] gas lime or alkali-waste, we should then have something to fall back on in the way of information when attack came, which could not fail to be of service. We all know that wireworms are attracted by rape cake, but what is the special method of action of the kind known as Kurrachee, or Indian rape, really mustard cake? When in my own experiments I have limited the wireworms to food consisting of little but one of the above two kinds of cake, I found that although the larvæ in the mustard cake feed as greedily as the others for a time, yet in about a fortnight they died; and although when they began to perish I placed other food in their reach, they appeared past recovery and did not touch it. We know that mustard is a good clearing crop, a good means of getting rid of wireworm, and in experiments with the cake I found that wireworm would not enter it until the pungency which follows on mixing this mustard cake with water was gone off, and I would suggest that inquiry into the precise method in which mustard is obnoxious to wireworm would be very useful. If this matter was fully investigated we might find that by a more frequent introduction of mustard into the rotation of crops, we not only cleared the land of wireworm, but on suitable land secured a paying crop of mustard free from the ravages of the mustard beetle, which is too apt to become a ruinous scourge to this crop in districts where its cultivation is widespread and continuous. Time does not allow me now to enter on full details of prevention of the pest we are especially considering; but I wish to draw your attention to its absence sometimes following on the application of seaweed being a matter worth inquiring into, as in this case we have the advantage of a manure often procurable at small cost which contains the alkaline and nitrogenous and mineral constituents we have seen are generally serviceable, joined in some cases to an amount of salt distasteful, to say the least, to the wireworm. We seldom need any teaching as to how a crop insect injures us; that part of its life history is commonly only too plain. But where is it at other times? Where does it pass the winter? How deep does it go down into the ground? What special weeds encourage its presence which we, or perhaps our neighbours, are apt to grow in ornamental patches, making, as it is poetically remarked, the country to glow like a garden! But, so surely as you see that golden glow from the charlock blossoms, may you expect a following of turnip fly; so surely as you see the blades of couch grass, or water grass, or any grass or weed in number in your crops, may you be sure there grows a home for wireworms. And so it is with other parts of the attack. Destroy the wireworms (as we have seen can be done) in the land that is infested before you put in your new crop, and it will in great measure escape. Destroy the rubbish in which the turnip beetle shelters in the winter, and destroy the plants where it feeds until we provide more pleasant sustenance at great cost, and we save much of our crop.—*North British Agriculturist.*

THE CULTIVATION OF TEA &c.

At a recent meeting of the Maskeliya Planter's Association, Mr. T. C. Owen read the following paper upon the cultivation, &c., of tea adopted in Assam and Darjeeling, as compared with that of Ceylon.

Tea, Coffee, Cinchona, Cardamom, and Aloes.

Mr. Chairman and Gentlemen,—The subjects which I propose to bring to your notice to-day deal entirely with those products which are suited for supplementing or replacing the cultivation of coffee, more especially at high and medium elevations. I must premise that I am not one of those who think that remunerative coffee cultivation is altogether a thing of the past, but this subject has been dealt with in such an able way by others, and I so fully concur in all that they have said, that any further remarks on that point are unnecessary.

Of the various produces with which it is proposed to replace coffee, the one which is at present attracting the greatest attention is undoubtedly tea. Eight years' experience of its planting and cultivation in Ceylon, with the results of an extended trip through the Assam, Darjeeling, and Terai districts, which I was able to make recently, have enabled me to form some conclusions on the subject which may be of interest to others.

The general conditions under which cultivation is carried on in Assam are utterly different from those which characterize the hills in Ceylon; the nearest approach to our circumstances being found in the Darjeeling hill district, which therefore possesses a special interest for us. The land there is very steep, as steep as anything that is generally planted with coffee, but it is worked in a different way. In Assam and the Terai the land is perfectly flat, that which is suitable for tea consisting of raised banks of dry soil surrounded by swampy land unfit for cultivation. The soil in Darjeeling is very variable. The upper portions of the hills are yellow clay with very little surface soil, but the clay seems to be especially rich, for the tea flourishes in it wonderfully. Lower down towards the ravines and rivers, the character of the soil entirely changes, and it becomes a rich black micaceous loam of great depth. In the Terai, the surface soil is very rich and fertile, but underlying it at no great depth is a barren gravelly subsoil; the result is that when young the tea flourishes luxuriantly, but when old the results become disappointing. Assam has a very rich loamy soil in most places, which is exceedingly deep, 20 feet and more sometimes, and of a remarkably fertile character. It is evident that the success of tea depends on the depth and quality of the subsoil more than anything else. The Darjeeling clay is very similar to what we are so familiar with in Ceylon, and the fact that tea sends its roots down into it freely, and grows healthily, should make us confident as to its future in our stiff lands.

Now, this subject of soil is a very important one for us; its importance cannot, in fact, be over-rated, and the chief question we have to decide is this:—Is the Darjeeling hill-soil of such a nature as to lead us to hope that our Ceylon tea will be a *permanency*? That our young tea will bear, and bear well, has been conclusively proved, as I shall show later: *will this last*? As I have said, the Darjeeling soil is very variable; some are apparently very inferior to much of ours (I speak as a practical planter, not as an agricultural

chemist); some, superior to anything we have. As an illustration, I will take go the Singtoen estate. The upper portions of this garden are stiff and clayey that a walk of half-a-mile down-hill, without a fall is a real feat. As we go lower the clay becomes covered to a greater depth with a rich black micaceous loam. This garden is a very old one, and without manure of any kind the tea is yielding a better crop this year than it has done for a long time. The estimated yield is about 320 lb. an acre, a large yield for the locality as I shall show later. The manager tells me that the lower portions bear better than the upper, but the latter, in spite of having an inferior *jat* of tea in them, and in spite of a less favourable climate, bear well and pay handsomely. I have also seen land very much of the same character as some of ours up country, a light loam, growing good and permanent tea in the same locality, and I unhesitatingly say that *if you have depth* you need have no fear of its future. The Terai is a most important instance of the uselessness of rich soil if an unfertile sub-stratum underlies it. We have not, as a rule, rich soil in these districts, we have nothing as good as the soil of the best localities in Assam, but we have better soil than some districts even in that favoured province (and as an instance I will name Gowhatty), and we have plenty of it. Those that have a good depth of such soil as I have described on their estates, although it is not apparently very rich and even though it is clayey, may plant tea without fear for the future; but I would warn you against shallow soils over-lying gravel or rock as sure to lead to disappointment.

In all the Indian tea districts there are great changes of climate during the year, to which we have no parallel down south. In October the approach of the cold weather begins to be felt, and in November and December there is a veritable winter characterized by snow on the upper Darjeeling gardens, which causes a universal stoppage of all growth. In March and April there is a uncommencement of growth again but this is not fully started till May. The consequence of this is that whereas in Ceylon we have growing and consequently plucking weather all the year round, in India they have only five really good crop-months. During these months their growth of leaf, and of weeds too, is of course far more luxuriant than ours. The unhealthiness of the Terai and Assam climate in the rains is proverbial, and I will not enlarge on it but merely point out that with expensive imported labour an epidemic means ruinous loss in every way, that with local labour it means wholesale desertion, and that it also means high and costly remuneration to Europeans and other employes.

In the matter of *jat* we are behind India. The fatal error of planting China and low-class hybrid was originally made in all the Indian districts: but now public opinion has run in the other extreme, and in the plains none but indigenous seed, at Rs. 150 per per maund, is bought, and on the hills a good high-class hardy hybrid is gone in for. And here I would warn every one against being induced to plant China or low-class tea at any elevation in Ceylon. Hybrid of the right kind will grow well, and inferior *jat* means a decreased yield and a comparatively weak tea. On Oonoagalla this year I manufactured the two separately, and sent them to the London market; at a recent sale the hybrid tea was well reported on and averaged 1s 4½d all round, whilst the China averaged 1s. 2½d. and was spoken of as a poor tea. Very fine tea is made from China plant in Darjeeling no doubt, but that from hybrid bushes is in every case finer when the two are grown together.

And not only this, amongst hybrid plants, the nearer the *jat* approaches the indigenous type, the stronger and more telling is the liquor and the better the tea. I have proved by experience that this rule holds good for both Ceylon and India. Plant, therefore, the best class of hybrid you can get hold of in these districts, even though it entails an extra cost, which, after all, spread over your acreage, amounts to a very trifling additional expense in opening, and you will never regret it. Coming fresh as I do from a country where I have seen old low-class tea being rooted out to give place to a better kind, I emphasize this statement.

As regards labour facilities, Ceylon has a decided advantage. The rate of pay in India is considerably less, Rs. 3 to Rs 6 a month for women and men; but then in Assam every imported labourer costs upwards of Rs. 100 for a three-years' agreement, at the end of which a bonus has to be given for its renewal, whilst there are numerous costly and vexatious Government restrictions. (Refer to copy of forms). In Darjeeling and the Terai, all the work is done by local labour which is very cheap, but here it is necessary in many cases to give over large areas of valuable land to the coolies for Indian corn cultivation (in one place I saw as much as 100 acres or more so treated); and this item, one which does not appear in any accounts, is a matter of some moment.

In transport, the many advantages possessed by Ceylon over Assam are evident, but Darjeeling in this respect, as in the matter of labour, is more on terms of equality with us. At present, the only means of communication with Assam is by a steamer-service on the Brahmapootra, which charges the most exorbitant rates for freight up, and which is scarcely more equitable in its charges for tea down, to Calcutta. About three cents per lb. seems to be the lowest average cost for tea down from Upper Assam to Calcutta, and this would be higher when much land-transport is necessary. The freight upon tea lead, nails and all factory requirements is however the most serious item, and the one which makes all these necessaries so expensive when landed on the gardens. Darjeeling, with its railway up into the district, is much better off in this respect, and were it not for its small yield would be a dangerous rival to Ceylon. The Dooars, a district situated at the foot of the hills, similar to the Terai but to the east of it, possesses almost the same advantages of transport and labour as Darjeeling, and is better circumstanced in the matter of soil than the Terai. This is undoubtedly the rising district of India, and the one which will run us the closest in the future.

The Indian methods of planting and cultivation are very different from ours. Nurseries cover a much larger extent of ground, the seed being generally put in five inches apart to allow of ball planting which is universally practised. It was the general opinion that plants put out in the Ceylon way, without any earth about the roots which are sometimes lightly pruned, would not stand a chance owing to the excessive power of the sun when it does show during the rains. The general planting distance for hybrid bushes is 4 by 4, indigenous plants in the best land in Assam being put 5 by 5 and sometimes even 6 by 6. The first distance mentioned is by far the most general, and the one suitable for adoption in Ceylon, though very poor land of course might be planted closer.

As regards planting, Mr Armstrong has anticipated all that I had purposed saying on the subject. I have found by experience that attempts to suit lining-distances to that of the coffee is a great mistake. It is far better to line the field *de novo*, without any regard to the coffee trees, the lining rope being stretched along the ground. As to holing, I would always make the holes 15 in. deep, and have found that a deep hole does best, breadth is of little consequence; nine inches, about sufficient for the cooly to work in, is enough. A good lining-distance through coffee is 3½ ft. up the lines and 4 ft. between them, and this latter distance should not be decreased except in very poor land.

Various schemes have been suggested as to the best way of combining coffee and tea cultivation until the latter begins to yield. Now I would strongly dissuade any one from attempting to raise certain lines of tea before others as sure to lead to trouble. For instance, some people plant lines of tea up between the rows with a plant between each pair of coffee trees up them, intending in two years' time to uproot the coffee, and put a tea plant in instead. This or any similar method will infallibly give great trouble, and probably result in a patchy garden. When supplies abound, the difficulty and trouble of keeping pruners and pluckers from touching them is inconceivable to those who have not experienced it.

Steep land in India is very commonly terraced. The lines of plants are made across the face of the hill and not up and down it, and the terraces are formed by a succession of hoeings along the lines. On stiff land terracing is dispensed with, and though no drains are cut there is remarkably little wash. The ground is always kept covered with a thick growth of weeds, which in the flats are kept down by constant hoeings, on the hills by sickling. The land is so thoroughly impregnated with weed seed and the growth of all vegetation is so rapid during the rains, that clean weeding is an impossibility, and those methods of cultivation are the only ones possible. Draining, too, is impracticable in many places when there is not a stiff sub-soil to cut into. The result of observation is to convince me that, whilst our present system of cultivation is the right and proper one, and incapable of improvement as far as India is concerned, that adopted there is the only practicable one under their circumstances. Their system is of course a much more expensive one than ours, and, in spite of the fact that no cultivation whatever is required during the cold weather, the rains being the only time when hoeing is necessary, its cost is upwards of three times as much as that of clean weeding from the first. The growth of plants under the most favourable circumstances in Assam is about on a par with that in the Ceylon low-country, but under ordinary conditions I think it is hardly as satisfactory. This method of comparison is, however, a very unsatisfactory one, and in view of the facts and figures now at our command, it is unnecessary. Suffice it that, broadly speaking, a two year-old-plant will be much the same size on a good Assam garden as on a Ceylon low-country plantation, whilst on the hills it is impossible to make any comparison between India and Ceylon, the advantage in favour of the latter being so astonishingly great.

The great point is, of course, yield. How does the Indian yield compare with that of Ceylon gardens? Amongst the numerous Assam gardens I visited, the best in every way, cultivation, *jat* and soil, was the Borelli Company's, and it is known as one of the best in Assam. The yield last year was 7¼ maunds or 580 lb. per acre. This and a few other gardens of specially fine character apart, 3, 4 and 5 maunds per acre represent the yield of the bulk of the good Assam plantations, say from 240 to 400 lb. (p. 297, *T. T. G.*) From my experience of the Ceylon low-country, I feel convinced that a yield, as high if not higher than the exceptional one previously mentioned, will be very generally got on good gardens, the average being much higher than that of Assam. But our more immediate subject is a comparison of hill-tea in the two countries, and on this point there can by no possibility be a difference of opinion. The ordinary yield in Darjeeling is between 2 and 4 maunds per acre, the latter amount being considered remarkably good. There can be no question, from the results already obtained, that this will be very considerably exceeded in Ceylon, and we are all aware of numerous instances to show this. I need here merely refer you to the figures brought forward by Mr. Armstrong in support of this statement, which show conclusively that his estimate of 400lb. per acre for hill gardens is by no means an over-sanguine one. I think this estimate of yield, judging from your soil and climate and in respect of the results actually obtained elsewhere, is a very reasonable one, and not likely to prove misleading. Actual figures and results apart, a visit to the Indian tea gardens is quite sufficient to show plainly their inferiority to ours; the period of growth during the year is very short, and at a high elevation insufficient to force out any considerable quantity of leaf.

Regarding quality of tea, there is little to be said in view of the very fine prices now being obtained by all properly managed estates. To any one comparing Ceylon hill and low country teas with those from the [illegible] Indian districts, it is evident that ours possess a character of their own, and that they are not altogether comparable to Indian. Our low-country teas have not the rasping pungency of Assams, and this difference is more marked in the coarser qualities than in the finer. Our hill-teas also have none of them the Darjeeling flavor, but are characterised by a distinct hill-flavor peculiar to them. It

is a peculiarity of Ceylon teas that those grown in the low-country possess a flavor combined with their strength which Assam's lack. There is one fact very generally lost sight of in comparing the prices of Indian and Ceylon teas, and that is, that most of the best marks are sold locally in Calcutta, and do not of necessity appear at public auction in the London market at all. Though, therefore, the position already taken by Ceylon tea must be a source of satisfaction to all interested, we must not suppose that we have attained perfection by any means, nor must we imagine that India is already behind us in the race for quality (*I. T. G.*, p. 303.) That there is in reality not much we have to learn is the conclusion forced on me by visits to numerous factories, in various localities, but yet there is something; and there were few gardens where something to improve or something to avoid was not noticeable. And here I must put on record and mention the excessive kindness and hospitality which is to be met with everywhere in India; not one single garden did I visit where everything was not thown open to my inspection, and where every information was not given.

I will now say a few words on manufacture, as far as Mr. Armstrong's paper leaves me the opportunity. The system of manufacture as described by him and practised by us agrees very closely with that in India. Falling trays for withering are not generally in use. In Assam large temporary iron-roofed sheds are erected, consisting of 2 or 3 stories, and in them the leaf is thrown. In Darjeeling more permanent buildings are erected, and the leaf spread on flat round bamboo baskets, which are roughly made and ranged in tiers on racks to support them. I think our system is preferable, as being an economy of space, but I would advise that a portion of the withering-house be left free, and that here a number of loose bamboo trays be stocked, in which sun-withering when necessary can be arranged. In our damp climate it frequently happens that by the morning the leaf is still unwithered, and half-an-hour's exposure to sun or light will finish it off and save time. Hand-rolling is unknown in India, as far as my experience goes, and even for the second rolling after fermentation a machine is employed. Regarding so-called fermantation—for I believe this to be a misnomer and that oxidation would be a more correct term—it is a good plan to mix the roll several times during the process, as this makes the colour much more even. In fact, in a hot climate, I would employ boys in turning the roll over constantly, and I have seen some of the best manufactnred teas in Assam and the Terai made this way. It is not a bad plan, after machine-rolling, to sift the roll through a No. 4 sieve and ferment the small and big leaf separately; this will enable you to colour your coarse souchong leaf without overdoing the pekoe and broken. Where roll is constantly turned however (and it is quite practicable where colour is obtained in an hour or so), this sifting is unnecessary, an even colour being obtained without it.

As to firing. A machine-dryer, being generally purchased after the roller, the method of performing this work by hand is of some importance. The stoves recommended by Mr. Armstrong are better than the long open troughs sometimes used. But the system of firing in India is better than that that recommended by him. The shape and dimensions of the stove are similar, but the opening at the bottom is bigger, about 15-in. square. The air-hole, not alluded to by him, is a most important point, and on its size the efficient consumption of the charcoal depends. It should be about 9-in. high and 6-in. broad, and no grate whatever should be used. The whole bottom of the stove should be filled with charcoal and kindled until the mass is in a glow; then—and here comes the secret—the fire is masked by a thick layer of ashes, a stock of which is always kept on hand. In using a grate, the charcoal has to be lighted outside and brought to the stove glowing, to prevent the possibility of smoke from ill-burnt fuel, and a great loss of heat is entailed by this. 1 lb. of charcoal does 1 lb. tea by the Indian method, as against a bushel of charcoal to from 8 to 10 lb. by the latter system. Again, 24 and 26 mesh-firing sieves as recommended by Mr. Amstrong have been given up in favour of 12 to 16 meshes. The larger meshes allow the tea to fire quicker, and very commonly the broken pekoe is sieved out through them permanently, thus saving subsequent labour and the use of sieves during firing, at all times a troublesome method. I was told also, but cannot vouch for the fact, that burning was less common with a large than with a small mesh sieve, scorching being due to the wire getting too hot in the case of the latter. One man to six trays is the usual allowance, and each firer's tea is kept separate till the next day and weighed and even tasted separately some time. An Indian tea-house assistant can always point out his best firers.

Sorting is very commonly done by hand. With a China sieve (made of fine bamboo), I have seen a good man sift a whole bulk of teas through with a No. 10 only, all done by altering the angle of inclination of the sieve. In fact, much depends on the degree to which sieving is done, and work done with the same sieve by different coolies is not always similar. Much variety can be introduced into this work, but the great principle is to sift into as few qualities as possible.

Regarding Packing.—In chests, split canes are an admirable substitute for hoop-iron, or small clips which just embrace the corners. With this substitute for hoop-iron, I certainly think factories near a cart-road ought to use chests, and so effect the saving in lead, cost of packing and draft which this means. As to wood for tea boxes, in India, Burmah teak is generally used, and out of all the numerous species growing locally, none is yet in common use. In Ceylon, I have always used Mallebodde, that despised tree which every one co[illegible]. If seasoned properly and used soon, it is [illegible] in every way, being light, free from smell, and holding a nail well. It must not be kept too long, however, or insects will attack it.

The arrangement of the factory may well be left to the ingenuity of the manager, as it is generally a converted coffee store. The great points to be borne in mind are, that the withering-room should be immediately under the roof, and above all heat-creating machinery and stoves; that the engine-room or water wheel should be cut off as much as possible from the rest of building, also that ample *light* should be provided for everywhere.

In tasting, all defects in manufacture become apparent, and by means of samples the work being done in any factory can be checked. I have here the Awisawella estate samples which gained the silver medal in Colombo, and of which the bulk averaged 1s. 7½d. at the last sales, the broken pekoe fetching 2s. 7½d.; this was made under the same immediate supervision of a gentleman who knew nothing of tea manufacture nine months ago.

In regard to machinery, I have a few words to say. In a small garden that will not give bigger accumulations than 1,800 lb. leaf per diem to be worked off, a "Universal" roller and a "Sirocco" are most suitable machines. It is, however, an axiom in India that rolling and firing power must always be provided for about double the quantity of leaf that has to be expected under ordinary circumstances, and I think there are few Ceylon estates where the machines in question would be found sufficient during a rush of crop or a continuance of unfavourable weather. Presuming therefore, that quantities of leaf up to 5,000 lb. will have to be dealt with, an "Excelsior" roller is the best machine to erect, but I do not agree that a multiplication of "Siroccos" is either economical or advisable as suggested by Mr. Armstrong. Kinmond's No. 2 Dryer costs £220 and does the work of exactly four Siroccos costing in the aggregate £340, the cost of erection of one machine as against four would make the divergence still greater. Teas from Siroccos are characterized by a very brisk full liquor, undoubtedly superior to those fired over charcoal; but having had opportunities of sampling them against teas from Kinmond's machine, I am strongly of opinion that the latter carries off the palm. A Kinmond's machine requires five coolies to work it; four Siroccos would require twelve coolies to keep them going. So that, in original cost, working expenses and efficiency of work, the policy of erecting one good machine is preferable to that of maintaining several inefficient ones, however satisfactory the quality of their work.

And now as to the machinery; for gardens working off upwards of 10,000 lb. leaf per diem: two "Excelsiors," may be erected, or one "Haworth's" roller. This latter machine is very popular in Assam, and will roll 1,100 lb. leaf an hour. I believe the cost is about the same as an "Excelsior," but am not quite sure. The machine consists of three parallel rollers revolving very rapidly in the same direction. Between them the leaf, enclosed in a bag, is placed. This machine does excellent work. Of dryers to work on a large scale, there is none to equal Gibb's and Barry's. This machine consists of a long iron cylinder, made to revolve in its axis, and with a slight slope towards one end. Hot air is driven into it by fans along a shaft which traverses it from end to end. The roll is put in at the upper end, and comes out at the bottom ¾ fired. The temperature of the hot air is from 650° to 700°, as against 752° for the Sirocco. To finish the tea off, it is put through again from time to time as the ¾ fired tea accumulates, at a reduced temperature. Those who have sampled teas from these machines would be able to recognize the *high-fired* flavor and the peculiar twist of the tea any where, and they like it better than teas from any other machine yet invented. The higher the temperature at which tea is fired the better the liquor, provided always that there is no burning; and under-firing arising from over-caution in manufacture is a very common fault with us. The cost of this dryer would be about Rs. 4,000 erected, and it requires about ¼ H.-P. to drive the fan, as does Kinmond's, but it is unquestionably the machine of the future. I would add that for this enormous quantity of tea, three coolies only are required.

As to sifters. I believe as efficient an apparatus as any one requires can be made and erected on the estate, without large outlays in patent machines, and I saw many of the former in India. The most favourite patent machine is Ansell's, and the saving it effects in the cost of sieving is very great: in the Borelli garden one such machine saved Rs. 750 expenditure during last year alone. It does not, however, do very effectual work, as the pekoe is not properly taken out; and I have seen tea put through it three times before it could be said to be thoroughly done.

To describe the numerous other forms of machinery and small appliances would take up too much time, but I hope to publish my notes on them shortly.

To sum up this subject, machinery as applied to tea manufacture is universal in Assam, and, in forming our estimates in Ceylon, we might as well draw up the figures for coffee without pulpers, on the supposition that coolies would tread out the cherry with their feet, as against the advantages in every respect, including cost, efficiency, saving of labour for other works, economy of space, &c., &c., when compiling figures in connection with tea. Comparisons of cost with India, where machinery is almost universally employed, are misleading unless we credit Ceylon with the same advantages.

And now regarding the cost of putting teas in the London market. What has gone before will have shown that, in respect of labour, transport and field cultivation, we have a great advantage over Assam, a slight one only over Darjeeling. There is yet another advantage in our favour. During the protracted cold weather in India, there is great difficulty in finding employment for the coolies. All crop work is at an end, hoeing is impossible, and the only work there is pruning. If, therefore, there is no new extension in which to employ the labour, much of it has to be put to unremunerative works. In Assam with imported labour, the difficulty is especially great. The Government insist on the payment of coolies whether employed or not, whether sick or well; the four-days-a-week system is impossible. Now, in Ceylon, with our continuous growth which allows us to chose our own time for pruning, matters can be so arranged that no protracted slack season occurs, plucking in the first pruned portions commencing before pruning is ended. What a great advantage this is will be appre-

ciated by all who have in years gone by had to support large crop labour-forces with no work to give them. With the disadvantages enumerated, the cost of Assam tea delivered in London ranges generally between 10*d.* and 1*s.*, though often over the latter amount. Taking the lower rate at which the Borrelli garden is quoted, and deduct 2½*d.* for freight and London charges, we have a cost of 7½*d.* f. o. b. in Calcutta. The average cost of the whole of the Land Mortgage Bank's Darjeeling gardens is 6½*d.* per lb. in Calcutta, shewing the advantage the latter district has as regards economy of working, for, in spite of a very much smaller yield, the cost of production is less by 1*d.* per lb. Now with proper appliances in the way of machinery, and with the various economies in the matter of working which come with experience, there is little doubt that gardens favourably circumstanced can put teas in Colombo for 30 cents or 6*d.* sterling per lb., a yield of 400 to 450 per acre being given. In this case we have an advantage of ½*d.* per lb over Darjeeling, due to our superior yield, and of 1½*d.* per lb. over one of the exceptionally good estates in Assam, the majority being at far greater disadvantage. It will perhaps be thought that 30 cents per lb. is a low estimate, but judging from the cost of the various field works and of manufacture in the large Indian factories, I feel convinced that we shall be able to work for this when our estates are in full bearing, and when we have provided ourselves with roomy factories and the proper labour-saving appliances. At present, with only a rolling machine and with much young tea, 36 cents per lb. is what its production is costing me, and it is easy to see how the 6 cents can be saved in the future.

It had been my intention at this point to enter into details regarding the cost of production, and to show how the figures quoted above were arrived at; but in view of Mr. Armstrong's recent paper on the subject, and of the very close approximation between my figures and his, I will not do so. Mr. Armstrong gives the cost of production by hand-rolling as 39 cents per lb., with machinery 31½ cents: both these estimates include the manuring of 50 acres and a yield of 400 lb. A slightly increased yield, or superior situation as regards transport, water-power, or timber supply would at once bring the cost to the figure I have quoted, 30 cents, or even below it. In practice, the cost will be found to lie between these figures 30 and 32 cents, according to circumstances, with an additional 7 cents where machinery has not been erected.

The average of the four estates enumerated by Mr. Armstrong is 34 cents f.o.b. *without machinery*. With the proper appliances the cost would therefore be well below the figure I have indicated, but probably the estates in question have done no manuring, which, if done on the scale indicated, would about cover the difference.

And now I am going to say a few words on the subject of pruning and plucking. The object of pruning is to secure as large a surface as possible for subsequent plucking, and it therefore follows from the growth of a hybrid bush, which generally has a clean stem for some inches above ground, and, above that, lateral branches growing in an up right direction, the higher the level at which the bush is cut, the greater the surface will be. Again, whilst all trailing side-branches should of course be cut off, it is evident that any *shortening of healthy laterals is* a curtailment of the size of the bush, that is, of its plucking surface. For some years in Ceylon we were in the habit of cutting our hybrid bush at 2' 6" and over, *never under* (exceptional circumstances apart), we are thus enabled to get a large plucking surface at this height, and this system, graphically described by Mr. Armstrong, is the one I most strongly advocate, and have always practised. When the late Mr. Cameron took up his work here, he changed this method in all the estates under his management, and introduced a severe cutting down system. Now the effect of cutting down young bushes, and at present I am confining my remarks to these, is to immediately induce a bush of wood supported by all the youthful vigour of the tree; if this is allowed to grow up, a new tree will be formed, and will be supported by the mass of foliage on the new growth. If however this is plucked and kept at a low level, sufficient foliage is not maintained to nourish the tree and promote a healthy growth of root and stem. The only circumstances under which low pruning—stick pruning as it is called, is resorted to, is to remedy the effects of injudicious plucking and pruning on old worn-out bushes. In one case only did I see this plan resorted to in India. An old piece of tea, the upper branches of which had got gnarled and hard, was cut down to within one foot of the ground; the growth which succeeded was however allowed to attain a height of 2 feet, to mature in fact, before it it was touched. This remedy would of course never have been necessary; the trees could never have got into this condition had a proper system of selecting wood and cutting out all that had got hard and unprofitable, been followed out at the yearly pruning. With young tea, however, the great point is *easy treatment*, if a permanently profitable bush is required; and in succeeding years, with proper scientific pruning, cutting down should never be necessary. Mr. Armstrong has laid down a few concise rules on the subject, which all should study carefully and follow consistently, and I will not attempt to confuse matters by giving a repetition of his advice in other words. China tea has, of course, to be pruned in a very different way to Assam hybrid, the former is a bush, the latter a tree, and as such they have to be treated.

The style of plucking depends greatly on the pruning which has preceded it, on the type of plant, on the climate, and so on. In this work again, Mr. Cameron introduced a new system, very different to that which we had always followed previously. It is generally considered that the point of his system was the plucking of the whole estate in eight days, but this is scarcely correct. The perfection of work theoretically would be to round of the estate at even shorter intervals; the point is, what is the description of shoot allowed to be plucked at each round? We might go round the estate every week taking shoots with five leaves and not less, or we might, at similar intervals, take a leaf and a bud as our minimum, and both would be weekly pluckings. In India the system of severe pruning and close plucking in question has been tried, and was discarded years ago as being fatal to the well-being of the tree. The matter was made a subject of discussion by me with several of the leading Indian planters, and in every case the system was condemned in the most unqualified way as being a very seductive one giving fine strong teas and a good immediate yield, but as being absolutely fatal to the future of the plant. Now, the fact of the system having been such a fatal one in India has been stated by many—and I believe Mr. Cameron did not deny this himself—but it is maintained that in Ceylon circumstances are different, and that the system, though a failure there, will succeed here. I uphold that in Ceylon an easier style of working the tree, one which draws less upon its energies, is essential for its well-being, and for this there are good and sound reasons. With a very vigorous growth, concentrated so to speak into a few months, such as they have in India, severe plucking will, it is reasonable to suppose, be answered by determined efforts on the part of the tree to form wood: this is the case, but the result of the treatment is that the tree wears it itself out in few years, sulks, and has to be allowed a rest before it can be made to yield again, whilst liberal applications of manure are required (in one case, and I here allude to the Chittagong estate which Mr. Cameron was in charge), of a years' rest was necessary after two or three years of this treatment. If this is the case in India, is it not reasonable to suppose that the same system, extended over the long flushing period of Ceylon bushes, with the less vigorous growth which accompanies them, should have an even more fatal effect? I cannot think there can be two opinions on the point, and from what I have seen of the results of the system in the low country and in the hills too, I feel convinced that disappointment is in store in the future for those who continue to take too much out of their bushes by hard plucking following the severe pruning. I have seen stretches of tea in the Ceylon low-country, after a few weeks' dry weather, looking as if a fire had run over them where Mr. Cameron's system of plucking has been strictly adhered to. It is obvious that unless sufficient leaf surface is left on each shoot, the circulation of sap *cannot* be maintained, and hence on the occurrence of the first trying weather, the whole shoot, on which depends the crop, and on the vigour of which depends the quality of our pruning wood for the succeeding year, is irremediably ruined. Just as we must treat our young trees easily, by topping them at first at 3ft. to 3ft. 6in., with a view of preserving the foliage on which their vigour depends and until the last few pluckings when less care is required, systematically leaves sufficiency of leaf-surface on the shoots that are yielding us our flushes. In plucking, as in pruning, Mr. Armstrong and I are advocating no new system: we are simply maintaining the one which we, with Mr. Taylor and others, have always consistently followed, and on which have attended results which, *as a permanency*, will be yielded by no other in India or Ceylon.

There is another point in which some difference of opinion appears to exist. I refer to the plucking of the *sides* of the bushes In view of the principle previously enunciated, that yield depends on plucking surface, it is evident that this practice is a bad one, and injurious to the growth of young trees. Under certain circumstances, it may be indulged in, but I have seen it practised and advocated in Ceylon where its effects could not but be injurious in the extreme. There are places where young tea so treated is seen dotted at intervals over the ground, instead of covering the hill-side with *trees*, visible as such even after pruning, and I have even seen an endeavour made to cure the defective yield by *supplying* what ought to be a sufficiently closely planted field. The effects of this treatment, justly deemed murderous by Mr. Armstrong, are so obvious that it is strange they are not apparent to every one. Coming from Indian tea, they strike me forcibly.

In respect of manuring there is nothing of importance to be learnt in India, and we shall have to gain our own experience. In some cases no doubt manure is applied, but these seem very exceptional. There is one more important point to be mentioned, the extension of tea cultivation in India as affecting our future prospects. An influential firm in Calcutta is now engaged in the most extensive opening operations in Cachar and the Dooars. I forget at the moment how many thousand acres are to be put into tea within a few years, but the extent is considerable. In Lower Assam and in Darjeeling, it is difficult if not impossible to get land, all that is available having been taken up long ago; but in other districts the openings are very extensive. I do not think however we need be afraid of this competition. At present prices, it is only by severe economy that good dividends are paid by Indian Companies, whilst we can well afford to produce tea and gain a fair profit, even should a fall of 2*d.* per lb. on the present market rate have to be faced.

In this case, I do not wish to make a statement without ample proof in the form of facts and figures to support it. Mr. Armstrong has here again forestalled me by showing that at his figures a nett price of *s.* in Colombo, or say 60 cents, is equivalent to a profit of Rs. 120 per acre, or, without manure expenditure, Rs. 132 per acre. Now, our present sale prices are showing averages of from 1*s.* 3*d.* to 1*s.* 8*d.* and over, well made teas rarely averaging under 1*s.* 4*d.* A fall of 2*d.* per lb. therefore would still leave a margin of profit which should be sufficient for any proprietor. Now let us see how such a fall would affect Indian Companies. The Borelli Company gave 8 per cent last year with a profit of 3½*d.* per lb.; Jorehaut 8 per cent at 1½*d.* per lb.; Doom-Doomea, 5 per cent at 1[illegible] lb. The Darjeeling Companies at an average price of 1*s.* 3½*d.* gave [illegible] cent, whilst the average price of 15 million lbs., tea as given [illegible] Thompson & Co., is 1*s.* 1½*d.* I will not multiply instances, those I have fixed upon including some of the most flourishing concerns, and what the effect of a considerable fall of price in their dividends would be is evident. "Low prices" is even now the burden of most reports. I have here the reports and statistics

from which these figures are taken, and shall be happy to show them to any one who cares to examine them.

Finally, I must add my testimony to that of others, and state that I consider these districts, judging from my Ceylon and Indian experience, to be well adapted to the cultivation.

The lay of land is perfect for a hill district. The soil is in spots poor, and not likely to grow good tea, but the large bulk of what I have seen has depth and is eminently suitable, whilst the lower portions of the district, judging from what I am told of their general character, could scarcely be better. That there can be no fear as regards elevation Mr. Armstrong's figures have conclusively shown, and the elevation of much of the Darjeeling tea adds weight to the testimony. The white clay which is found in the flats in some localities should not, in my opinion, be planted, the free soil of the hill-sides being much more suitable.

I should like to say more on this subject and many others in connection with tea, but time will not permit, and I must pass on to other matters.

CARDAMOMS.

I will now make a few remarks on the subject of cardamom cultivation. This product, when planted in proper situations is about the most profitable that we have in Ceylon at present; in unsuitable sites, however, it is usually an unmitigated failure. Shelter is essential to it, and it grows best in hollows, protected from the monsoon winds, and where there is generally an accumulation of rich soil. It does not bear well in poor gravelly soil, but prefers a rich loam. An important point regarding it is the question of shade. This should not be too thick, so as to exclude light and air, but should be partial only, and in such places cardamoms thrive best. Whether or not any extent of it can be planted in the open is as yet an undecided question with many. My personal experience is against it, as I have found that the growth of the plant is slow and the racemes very short when much exposed. In some cases individual plants in the open are found bearing fairly well; in other cases they do not bear at all in such situations, but it would seem as if a partial exposure only to the sun is not much against them. As to their cultivation amongst the coffee, there can be little doubt that it would be a success where the latter is thick, affording effectual shelter to the young plants but in such situations the coffee as a rule repays cultivation, and does not require to be superseded by anything else. In a few words plant cardamoms under forest-shade on any suitable land, but regard its cultivation in the open and amongst coffee as an experiment only. There need be no fear as to its bearing powers at this elevation, as I have cardamoms bearing freely above the elevation at which coffee ceases to crop. I would also mention that in the low country, at a few hundred feet only, they are bearing well. In a recent letter to the *Observer*, on the subject of cardamoms, published during my absence from the island, and couched in somewhat vague and incoherent phraseology, the writer states that the villagers have not the best variety of cardamoms, and that the somewhat obscure but ever valuable so called "Mysore" species should be rooted out. I merely allude to the matter to re-assure those who may have been misled by this rash statement, for, in the Kotmale, Peradeniya and Kandy villages, Malabar cardamoms are freely cultivated and those who know how to distinguish them run no risk in purchasing bulbs from these sources, whilst in high elevations the Mysore bears much more freely than the Malabar species. In good soil, cardamoms should not be planted too close, 7 by 7 in most cases, and 8 by 8 when the soil is exceptionally rich will be found right. Holes 18in. wide and 1 ½in deep should be cut, and the plant put in shallow, the earth not above the collar. This latter point is very important, as deep planting is fatal. In purchasing bulbs, the closest supervision should be exercised, and all that are cut about and injured (and the Singhalese are very careless in this matter) should be unhesitatingly rejected, double bulbs also should always be insisted on, and two single ones instead, such as the contractor will sometimes offer, be refused. The plants will begin to throw out racemes in 18 months at low elevation, but in these districts it will probably be 2½ or 3 years before they begin; to do so.

The cultivation of cardamoms is a very simple and cheap matter the stools must be kept clean and free from *débris* of all kinds, especially when the plant begins to throw out racemes. Weeding after the ground is covered will be found unnecessary, for nothing grows under their shade; it is, however, desirable to send a few coolies occasionally to clear up open spots and corners which sometimes get dirty.

In order to make the most of the crop to get the highest value possible for the yield of the small acreages we generally possess, the somewhat expensive method of cutting off the capsules with scissors must be undertaken, and they must be picked when first turning colour, before they are fully ripe. Ripe fruit invariably splits, as also a very large proportion of what is taken off without its stalk. The difference of value between split cardamoms and those which are alone fit for the home market is very great, as much as Rs. 1 for the former and 9s. for the latter in some cases. As regards yield, I have got crops varying from 120 to 300 lbs per acre. The cost of putting cardamoms in Colombo is 40 cents per lb., the average price from 5s. to 8s., a calculation of Rs. 2 per lb *nett* is, therefore, very safe. The profit which these figures leave is an ample one, and is shown in the appended estimate drawn from *actual results*.—[Mr. Owen here introduced and explained the estimate appended to his manual.]

CINCHONA.

I will now say a few words on cinchona, though I feel that after Mr. Christie's recent admirable little essay, there is not very much to be said. The advance in practical experience regarding this product has been very great, and in many cases I fear very bitter, during the last year or two. We have learned where cinchona will not grow, and that is an important point gained. I must, however, differ from Mr. Christie in one point. I do think there has been a very serious deterioration in the vitality of the stock, and I may state that Mr. Gammie, from his long experience of cinchona cultivation at Darjeeling, is of the same opinion. On the Rungbee plantation which includes periodical plantings since the original old trees were put out, there is a most marked falling off in the vigour of the trees in successive years. In this case, close planting is certainly not the cause nor is clean weeding, the trees growing very wide apart in a wilderness of jungle. Climatic influences are not a satisfactory explanation, the period during which cultivation has been carried on being so extensive. From my experience in Ceylon, I feel convinced that the trees we are now cultivating from seed grown in the island have not the same vigour as the original parents first planted, and that the second generation is even more enfeebled. It also seems to me that, as a rule, the parent trees do not now produce progeny with the same vitality as in years past. The remedy for this would appear to be fresh blood. Regarding the hybrids, a class of plants originating locally, the case seems different, and it would almost appear as if nature were pointing the means by which the gradual extinction of the local cinchonas is to be avoided. This subject and many kindred ones connected with the cultivation of cinchona, and the harvesting of its bark, are of great interest, and I should like to enlarge upon them; but time is short, and I must bring this paper to a close.

Speaking generally, it would appear that the most profitable way of cultivating our land in the future is to keep up the very best portions only of our estates in coffee, and to cultivate these highly, spending what we can afford upon them. The bulk of the coffee might then with advantage be lined and planted with tea, suitable portions of the land being kept in cinchona. To cardamoms, any available forest of the right character might be devoted. On many estates there is unfortunately no forest, and the fact must be faced that for tea cultivation considerable forest reserves are desirable. When no wood is obtainable, the use of coke or fuel brought up by railway will be necessary, and this difficulty and the necessary expense must be faced from the first, and should on no account be ignored or forgotten. It may be of interest here for me to state that tea dryers require 2lbs wood to each 1lbs. tea, as a rule; therefore, a 250-acre estate, yielding 100,000 lbs. tea, requires 200,000 lbs. or 90 tons wood per annum *at least*, practically more; where water is not available, a calculation must also be made regarding the fuel required for the engine. For the planting of bare ridges and still unfruitful ground where cinchona does not thrive, a product is required. I would suggest aloes, for the cultivation of fibre plants is undoubtedly an industry to which we shall have to turn our attention in the future. The aloe once in the ground, all expenditure ceases, save perhaps a few weedings round the plants until they are established. Advantage has been taken, by those whose aim it appears to be to run down all present and future enterprise, of the somewhat enthusiastic way in which the wholesale planting of new products is advocated by many; and, now that their success is established beyond doubt, it is stated that they are being planted wholesale, in suitable and unsuitable localities alike, and further disappointment in the future is predicted. Now far be it from me to advocate the planting of any product in an injudiciously wholesale manner; tea, hardy plant though it is, will not pay on washed exhausted soil, nor on our poor shallow land, and such localities had better be allowed to grow up in jungle after the establishment of some hardy plant, such as the aloe, which is able to hold its own against all other growths. The selection of the portions of estates which are to be maintained as coffee, or planted with tea, cinchona and cardamoms, is a matter requiring judgment and experience, and on the degree of these qualities that is brought to bear on the subject will depend much of the future success of the estate. It is, of course, a matter to which no rules are applicable, and one to call forth all the powers of proprietors or their advisers.

Gentlemen, I have done. In view of the too recent publication of Mr. Armstrong's able and comprehensive essay, my humble effort appears at the greatest disadvantage; but I trust you will make every allowance for the fact that, at a few hours' notice and in the brief space of a portion of a day without any notes and other means of reference, I have had to re write the greater part of this paper, so as not to come before you with a mere repetition of anything said by that gentleman, and with a view to make my statements supplementary to his, and hence of value and interest to you. If you consider that I have been, in however small a measure, successful in this task, the difficulty, of which I only appreciated yesterday when I entered upon it, I shall feel amply rewarded.

T. C. OWEN,
Oononagala, Madulkelee.

—*Ceylon Observer*.]

CACAO.

THE PREPARATION OF CACAO BEANS.

WE are indebted to Mr. Prestoe, Government Botanist of Trinidad, for a copy of a communication which he has addressed to the *Trinidad Chronicle* on the subject of the curing of cacao beans. Mr Prestoe is good enough to bear valuable testimony to the merits of the *Tropical Agriculturist*, while he pays the Ceylon planters the high compliment of showing that in the new pursuit of cacao culture and preparation, they have improved upon the methods in use in the West India Colony which is specially associated with cacao,—Trinidad. We reprint the communication, which sets forth with clearness and emphasis

the benefit of following up the fermentation of cacao beans in their mucilage," by clean washing and sun-drying. In cacao, as in tea culture our planters seem likely to take a foremost, if not the first place in the world.

(To the Director of the *Trinidad Chronicle.*)

Dear Sir,—I cannot tell to what extent the *Tropical Agriculturist* is read here in Trinidad, I fancy however only to a very limited extent—probably not more than half a dozen copies being received in the island. This uncertainty on my part must be my excuse in a measure for troubling you for the favour of space for a few words anent one of the many subjects that go to make up its contents, and meanwhile allow me, in view of promoting the agricultural interests in Trinidad, to offer my testimony to the really valuable character of this monthly, and which is perfectly unique.

The paper is published by the Messrs. Ferguson of Colombo, Ceylon, who are best known as Editors of the *Ceylon Observer* and *Directory.* It is a book of about 50 leaves, full to overflowing with most interesting and instructive matter, culled from publications in all parts of the world, besides its own original articles and correspondence, and which treat on every possible subject with which a tropical agriculturist, especially a resident proprietor, is likely to be interested in; a striking feature of the correspondence being narratives of the writers' experiences with these subjects or what they know of the experience of others—all with the object of effecting improvement in the agriculture and aiding in the general wealth of their colony.

The special value of this monthly, more particularly as relates to Ceylon, lies in its character as a means—and a powerful one—by the general information it affords for initiating and promoting the cultivation of new or little known products on the principle of dealing with as great a variety of subjects as the conditions presented in the colony may permit, in preference to concentrating all effort and attention to the development of one or two products, for which the conditions of the country may be *best* suited.

So far and so successfully has its influence operated in Ceylon (as well as India), that to-day we see—not, as here, the principal, exports consist of only one or two subjects, but of a dozen or more. Some of these besides the leading ones, are on such elastic bases that a leading export showing signs of falling off one year, some product of lesser importance is made to double its output in a single year—as seen at present in respect of Cinchona bark, Tea and Cacao—three striking examples which a perusal of this excellent " Tropical Agriculture " will afford ample information of.

The first two we cannot of course do here—for want of elevation, so that notice of their cultivation would be waste of time—but what of Cacao? With this subject there is an extraordinary increase of output—in the course of three years the export having developed from a few pounds obtained from a few neglected trees in the jungle, and which a happy thought had brought to light by clearing and pruning, to the present considerable export of 101,800 lbs., and which, besides, in the London market—by the beauty of its sample, is the envy of both buyers and sellers, and has accordingly settled down to a leading position in the market at 105s—abreast of the best from Trinidad.

Of course there is no reason why the very best Trinidad Cacao should not be better than it now is: or that the present Trinidad seconds and thirds, and even fourths (if such can still be cacao) should not be equal or very nearly equal to the present Trinidad best, and thus leave the Ceylon cacao at least a shade behind.

In order to obtain this desirable position it will be necessary—simultaneously with the adoption of a methodical plan for sampling our cacao into about five sets (of varieties)—to follow the system of Ceylon growers: what this is I venture to subjoin an extract from the *Tropical Agriculturist* to show.

From this it will be seen that—as I have previously advocated as indispensable, under a rational method of preparing cacao for the market and for realising the full value of the produce—the *Ceylon planters wash their Cacao.* Here, however, and elsewhere in the West, it is affirmed that to wash cacao is to spoil it both in the operation which breaks the skin, and in its after state: or that it costs too much to be practicable even when the sample is *improved.*

But these objections arise only from a want of appreciation of the requirements in the operation and—probably—carelessness in conducting it, if even such had been tried. Previous impression of the effects on the beans of the common practice of amassing, sweating, rubbing, drying (which is simply encasing the beans in their mucilaginous covering decomposed and dried with a considerable addition of foreign matter) must for a long time stand as an obstacle in the way of the Creole planter understanding a perfectly clean pale cinnamon brown light bean with easy fracture, as the right sort of sample.

It may be questioned what led the Ceylon planters to wash their cacao—for we may conclude they got no advice from their friends in the West to wash it.

For the answer we may reflect that the Ceylon cacao has been dealt with under the immediate supervision and manipulation, guided by the high intelligence of—for the most part—English and Scotch gentlemen resident proprietors or managers. They were suddenly aroused to the necessity of appropriating to the utmost anything in the way of cacao, and a few old trees neglected for years were at all once made recipients of their most tender regard and attention. The trees were bearing profusely, so that cacao had to be "cured" at once. Old papers and notes on the subject were hunted up, and cacao was found to be cured by being either "sun-dried" or "sweated" and dried, so the sun-drying process being the simplest was started; but then, there was so much mucilage, and after the first day, had become so uninviting in appearance that with their feeling of respect for everything clean, they concluded that their cacao was not going to be the right sort of thing for the English market—(though this was the first new cacao they had ever seen)—even if it could be dried, so they decided to wash it—for as one told me they could do nothing else with it—but the addition of water so greatly increased the mucilage as to leave it impracticable and besides the skin of the beans broke in the washing and thus the whole thing was thrown away—as actually happened in more than one instance. Further on it was desired to try what " sweating" would do, accordingly beans were put to sweat under the discomfort of wide diversity of opinion as to the period necessary for the " sweating." But being put to sweat, in the course of a few days the mass presented a disgusting appearance of rottenness that washing was again tried as one way of getting out of the fright: this time with very different results. The sweating had decomposed the mucilaginous covering of the beans, and light washing left them clean and as pleasing in appearance as new copper coins. Put at once in the sun, they dried in a surprisingly short time, and soon the result of the prized Ceylon Cacao of sweet mild flavour, cinnamon colour and free ' break,' was attained.

Before all this however a civilised practise in respect of fruit gathering was followed, *viz.* :—

Only the ripe pods were gathered, and thus the beans were uniformly affected in the sweating and drying and came out a uniform sample.

The process herein followed successfully was, therefore, briefly this :—

Only ripe pods dealt with; the beans amassed to sweat (being turned once or twice) then carefully washed and put in the sun to dry.

It may here be remarked that the beans being sufficiently sweated to admit of being washed readily, and yet not sufficiently sweated to have fully expanded their cotylidons—*i.e.*, the parts which become nibs—or to have reduced their acridity—can be returned for further sweating after the washing.

The drying being effected immediately after the washing or second sweating, mildewing and discoloration therefrom would never occur, and of course the labour of " rubbing" would be avoided. Necessity for prompt drying renders washing indispensable; for washed beans dry in one-third the time of beans covered with the decomposed mucilage; and as during the wet months artificial means for drying cacao, as employed with tea, is a great desideratum of the time—a point which it is my chief object in addressing you now to draw attention to—it should not be overlooked that drying by artificial means will not be practicable for unwashed beans—except for re-drying damp cacao, cured in the old manner.

It would be well for the cacao interest generally if, in view of the November and December rains, a practical consideration were to be given to this point at once.

It should never be lost sight of that cacao beans in bulk—not larger than the usual quantity of a " crook" basket or sack and if kept from the air by such a covering as an ordinary sack—will keep fresh and sound for 3 to 5 days, except as to the mucilage which will waste somewhat, as is desirable. Beans might therefore be brought in from all but the most remote parts to be carefully washed and dried at central towns or villages, with great pecuniary advantage both to grower and dealer. I am, &c.,

H. PRESTOE,
Government Botanist.

" CURING THE BEANS" (*Cacao*).

A cooly picks two bushels of cocoa beans per diem, and as five bushels wet = 1 cwt., the cost is only about 37c. a cwt for picking, as compared with Rs. 2 to Rs. 3 for Liberian coffee. The pods are first cut from the tree, a small piece of stem being left on the tree, and the cooly takes one in each hand and with a knock breaks them both in halves, and then with one draw of his fingers dexterously strips all the beans off the centre pulp. The pods are then thrown round the trees and act as manure, while the beans are removed to the fermenting cisterns. It takes from 5 to 9 days to properly ferment the cocoa, and it is then ready for washing. It is trampled first, as in coffee, with the feet, and then is removed in baskets and carefully handwashed, as washing with the " matapalagei" damages the beans. I have no doubt that ere long some means less expensive will be found for washing, and the clerihew will be much improved on too.

After washing, the cocoa is laid on mats to dry as coffee is, if the weather is suitable; and at times it is advisable to give it a rub over with small pieces of sack or cloth, which improves the appearance of the beans, and facilitates drying in this showery weather.

The difference in well cured and badly cured cocoa amounts to at least Rs. 20 per cent, and the prices obtained for it as in tea, will depend in a much greater measure on the careful attention of the superintendent to the curing, than in the case of Coffee Arabica, and the good man will have a better chance of coming to the fore, than in days of old with coffee.

CACAO CULTIVATION IN CEYLON.

ESTIMATES AND REMARKS.
(*By a Practical Planter.*)

Estimate for opening and bringing a Cocoa Estate of 200 acres into bearing, including cost of land.

Probable cost of 200 acres of land at R25		...		R5,000

1ST YEAR, from January to 30th June of following year.

Felling and clearing 200 acres at R15				R3,000
Nurseries : clearing sites ...	...	...	40	
80,000 baskets at R5·50	...	...	440	
5,000 cocoa pods, at R55	...	...	275	
Filling baskets and sowing seed	...	...	250	
Erecting pandals for shade	...	...	120	
Watering and attending	...	...	125	

Lining at R1 per acre	200	
Holing: 300 holes per acre 12 by 12 feet apart, 2 feet deep by 18 inches wide (20 per man) ...	1,200	
Filling in 75 holes per man	300	
Planting, supplying, and shading at R3·25 ...	650	
		2,350
Weeding for 16 months at R1 ...		3,200
Roads: 10 miles with inside drain at R1·50 ...		1,500
Drains: every half-chain apart, R10 per acre ...		2,000
Tools		500
Buildings: temporary lines	200	
Permanent lines	300	
Bungalow, out-houses and furniture ...	500	
		1,000
Contingencies: medicines and hospital charges ...	400	
Survey	200	
Stationery, postage, etc.	50	
Chetty's commission on cash	750	
Superintendence and allowances	3,000	
Conductor for 6 months	250	
		3,259
		R18,800

2ND YEAR from 1st July to 30th June.

Nurseries and supplying		R350
Weeding at R1		2,400
Roads: upkeep and culverts		400
Drains, upkeep		200
Pruning and singling		100
Staking at R4		800
Buildings: bungalow and furniture		3,000
Contingencies		500
Superintendence and allowances		3,000
		R10,750

3RD YEAR, from 1st July to 30th June.

Nurseries and supplying		R150
Weeding at R1		2,400
Roads: upkeep and widening out 3 miles into cart road width 10 feet		800
Drains upkeep		200
Pruning and suckering		300
Staking, retting, &c.		100
Building: temporary curing-house with stores and fan	500	
Permanent set of lines	700	
		1,200
Gathering, curing and despatch of 200 cwt. at R6		1,200
Contingencies, including watchers		900
Superintendence and allowances		3,000
		R10,250

4TH YEAR, from 1st July to 30th June.

Weeding at R1...		R2,400
Pruning and suckering		400
Roads upkeep		400
Drains upkeep		200
Buildings, permanent, clerihew, engine, &c. ...		5,000
Gathering, curing and despatch of 600 cwt. cocoa at R4		2,400
Contingencies...		900
Superintendence and allowances	3,500	
Conductor	500	
		4,000
		R15,700

5TH YEAR, from 1st July to 30th June.

Weeding at R1		R2,400
Pruning and suckering		400
Roads upkeep		400
Drains upkeep		250
Gathering, curing and despatch of 1,000 cwt. cocoa at R3·50		3,500
Building upkeep		200
Contingencies		900
Superintendence and allowances	3,500	
Conductor	500	
		4,000
		R12,050

Interest on Expenditure.

5 years' interest on cost of land at R8 per cent on	R5,000	R2,000
5 years' interest on 1st year's expenditure at R8 per cent on	18,800	7,520
4 years' interest on 2nd year's expenditure at R8 per cent on	10,750	3,440
3 years' interest on 3rd year's expenditure at R8 per cent on	10,250	2,460
2 years' interest on 4th year's expenditure at R8 per cent on	15,700	2,512
1 year's interest on 5th year's expenditure at R8 per cent on	12,050	964
	R72,550	R18,896
Add interest	18,896	

Expenditure for 5 years	R91,446	
Less 1,800 cwt. cocoa sold at R45	81,000	
Debt on estate at end of 5th year	R10,446	
Add for purchase of other 50 acres at R25 ...	1,250	
	R11,696	
The expenditure each year after this, allowing R3,000 for manuring, would be about ...		16,500
Against which put proceeds of sale of 1,000 cwt. cocoa at R45		45,000
Year's profit		R28,500
Value of estate at five years old with only 5 cwt per acre—this is at the rate of 5 years' purchase	R140,000	

As a few remarks on each heading of expenditure in the above estimate will make it more intelligible, I shall endeavour to give this with the aid of information received from friends of larger experience than myself, on many points connected with the cultivation of cocoa. This product being still in its infancy in Ceylon, no authoritative statement can be made as to the best way of cultivating it: but such knowledge as we have has been gained be experience, and can, therefore, be relied on.

The cocoa plant has been in the island for many years (perhaps over 30 years), but till within the last six it was not systematically cultivated. When our attention was drawn to this as a profitable cultivation, we were most fortunate in having at our doors a variety—perhaps the very best we could possibly have had—that has proved, by the vigor of its growth, its fruitfulness, and the range of elevation—from sea level to over 2,000 feet—at which it will grow and yield probably, that it is well adapted to our climate; and the prices realized in the European markets leave nothing to be desired. There are over a dozen other varieties of cocoa in the country, but, till we hear more about them, I would advise our sticking to what we know to be a prime favourite with buyers.

New estates opened were, until recently, planted under the shade of the forest, all the smaller timber being cut out and the larger trees left. This was found in about the second year of growth to be hurtful to the plants, tending to draw them up lanky and weakly. The jungle had, therefore, to be cut down carefully at considerable expense, and where shade has been left, it has been and is still being gradually thinned out. I believe the general opinion now is that direct shade is not good for cocoa, though it remains to be proved whether light and chequered shade is not beneficial.

Land.—The very best land that can be got should be secured for cocoa; the plant is a deep feeder, and to thrive well must have a good subsoil. Dunbara, parts of Matale, and Kurunegala have the best soils in Ceylon for its growth—dark friable chocolate of great depth; the vigor of the trees in such soils shows how they revel in it. But, alas! where are we to get soil of this description in any of the forests that are still remaining? Many of the chena lands in the low-country have very fine soil yet (the surface only has been skimmed), but the native titles are very defective; and if one does venture, and purchases small lot after small lot till he gets a fair-sized block, the difficulties and delays in the way of getting a "title of quiet possession" from the Government are most vexatious and almost insurmountable. We must therefore be contented with what we can get, and that is generally inferior soil. Light soil with a good deep subsoil is to be preferred to one with a rich surface soil, but hard impenetrable subsoil. Very steep land is to be avoided, but moderately steep suits very well; rich flats are the best. I have only estimated R25 per acre for purchase of land, but, in a few years, when capital returns to the country, and there is a demand for land for cocoa, I fancy it will not be got for double that figure. I have made an error in opening the whole of the 200 acres in the block; to admit of opening 200 acres, the block should have other 50 as a reserve. Even supposing that every acre was available that is suited for planting, it would be still necessary to leave belts as protection against wind, as, however well cocoa will do without shade, it will not tolerate wind. On no account should trees be felled in a locality known to be windy; and after the estate is opened, belts of suitable trees for shelter should be thickly planted in all exposed situations.

Nurseries.—For making these, flat land near water should be be chosen, and they should be in 3 or 4 different spots if possible, as this makes the carriage easier when planting out. Pandals of light jungle sticks and covered with small leafy branches must be put up, high enough to admit of a man walking underneath without stooping. The surface soil should then be scraped into heaps, and, the baskets filled with this, well pressed down with the knuckles, but not patted as the coolie is so fond of doing; the baskets being filled place them 6 deep in a row, and to any distance the space will allow in length; they must be placed perfectly upright, and to keep them in that position a "varachchi" tied to a few pegs driven into the ground on either side of the beds will do. If earth is filled into the spaces between the baskets, at about every 10 or 12 rows across the beds, it will be an advantage. This must be carefully seen to, for, if the coolie is left to himself (and kanganies and conductors are often not one whit better), the baskets are sure to be placed at every conceivable angle but the right one. The baskets being in position, just put one seed in each about one inch below the surface, the *broad* end downwards—some prefer to germinate the seed before sowing—after sowing water well. Any seed that does not grow in a fortnight should be replaced by a fresh one, and this should be done till there is not a vacancy. Owing to the greater and more rapid evaporation, the outside rows of trees suffer; to prevent this keep earth against the baskets

The plants should be watered once daily, and in very dry weather twice. I have allowed for enough plant to plant the clearing, and do the first supplying. I have never tried planting at stake, but believe it is sometimes very successful. Should the season, however, be a dry one, the clearing is sure to be very patchy, and I hardly think the risk worth the money saved. Some planters aver that they dare not use baskets, as the white-ants would be sure to attack them and destroy the plants: this is not my experience, except on a very small scale, but, where it is unfortunately so, planting must be done at stake, or plants raised in beds, the seed being sown 4 inches apart each way, and removed by Scowen's transplanter and Davidson's envelopes. This work should be *very* carefully done, the plants not allowed to remain over 3 months in the nurseries, else the taproots will grow too long, and, in withdrawing the transplanter, the plant, instead of coming out with the soil, will be drawn through it, and all its roots disturbed; such a plant will stand a poor chance in any weather. The transplanter should be frequently dipped in a bucket of water, as it makes the work easier, and the envelopes should be wetted and drawn through ashes; if this is not done the earth adheres to the envelope, and the labor of transplanting in many instances is lost. The shade over plants, whether in baskets or in beds, should after two months be gradually removed to harden the plants. At three months from sowing the seed, the plants are ready for planting out in the clearing. Baskets for raising plants can be got at Kalutara, delivered at the railway station, for from R4 to R4·50 per 1,000, and another rupee should land them on the estate.

Lining—All distances from 9 by 9 to 13 by 13 feet have been tried, and I believe that most are now agreed that 12 by 12 is the best; this is, of course, for our ordinary red variety: the pale green, white, and purple kinds would want 16 by 16 at least.

Holing.—Some prefer wide and deep holes—wider and deeper than I have estimated for—others prefer narrow and deep. The large holes are more expensive and possibly for the first two years the plants thrive better; with large holes staking is a necessity, whereas with narrow ones it may not be needed. It is well-known that for two years cocoa plants make hardly any lateral roots, sending down only a long tap; during heavy rains, the soil in a wide hole gets very sappy, and the plant having no hold is blown over by the least puff of wind. On the other hand, in the narrow hole, the few laterals the plant does make have holding ground at once, and they are thus stayed.

Planting.—This work should be done in the rains, and the earlier in the monsoon the better. One coolie will carry out and plant from 100 to 150 plants either in baskets or transplanter envelopes, according to the distance from the nursery and steepness of land. On hill-sides, the baskets should be buried 2 inches below the lower lip of the hole, so that, in the event of any soil being washed away, the roots of the plants will not be exposed; the earth should be well trampled, and the hole filled flush with the surface, to prevent water lodging and rotting the plant.

Shading should be done the same day as the planting, or the following morning, and tree-branches the leaves of which will stick on for 3 or 4 months should only be used; the best for this purpose are "Mora" and "Kebella." The cost of shading will depend greatly on the facility there is for procuring the proper shade stuffs, and, unless abundant near at hand, enough trees should be left when felling to give branches for shading, and cut down afterwards. In some parts of the low country, the leaves of the "Madu" palm are used; they are like fronds of the tree-fern, and answer admirably. I do not think it is necessary to cover the plant up entirely as is usually done; in my opinion, it is injurious, shuts out sun and light, and keeps hot air confined; and if the shade is attacked by white-ants the plant is bound to go, it cannot escape. The plan I prefer is as follows:—Chop your shade stuff into about 20-inch lengths, stick it upright at about 9 inches from the plant, *so that no leaves of the plant touch it*; run them along north and south for about 15 inches thus:—

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This will protect the plant from both morning and evening sun, which is really all that is needed, and will also prevent the too rapid drying up of the soil; should white-ants attack it, the plant escapes.

Supplying.—The first supplying should be done in the early north-east rains, and twice more in the following year, by which time nothing further should be needed.

Weeding.—This is a very important work, and it is very desirable that the clearing should be kept clean from the commencement. If the growth of weeds is great, weed once in three weeks till they are got under. It is quite possible that after a year or more the work can be done for 75 cents per acre, but do not resort to this till you are quite certain the rupee is excessive. I need hardly say, permit no scraper or mamoty weeding!

Roading and Draining.—These works should, if possible, be done before a lining peg is put in or a hole cut—work is facilitated and after-damage prevented, as well as a good deal of vexation and bad temper. The gradients of both roads and drains in the low country should never be steeper than 1 in 15, and for roads intended to be afterwards converted into cart-roads 1 in 25, and less if practicable. Roads should be cut 4 feet in the solid, with a foot deep and wide drain at the back of it: drains should be 18×18 inches. The cost of these works will depend much on the nature and lie of the land: if at all steep, what has been estimated will be spent; if flat, a large saving may be expected.

Tools.—As a large force of labour will have to be employed to get through the work in proper time, the estimate for these will not be too much. See that you buy nothing but good articles!

Buildin; Lines.—20 rooms, roof and walls of cadjans or talipots, can be erected at a cost of R10 a room, site included—which will be water-tight and comfortable and last for all the time they are wanted; they can be run up in a few days—a great consideration, and there is no risk of the coolies catching illness from wet mud-walls and damp floors. A line of this sort should accommodate 100 laborers. A good deep drain should be cut *all round* the line to keep the floors dry. A permanent set of rooms can be built at leisure, to serve for those coolies who will remain after the planting is finished. It may seem that the accommodation provided is insufficient for the large force that would have to be employed; but if it be borne in mind, that, in the low country, much of the work would be done by Sinhalese, on contract or day-work, and who would live in the neighbouring villages, it will, I think, be found ample.

Pruning and Suckering.—In the first year, all doubles must be cut away, leaving only one stem. At two years the plant divides usually into three branches or forks, and then begins to make a head. All cross-wood within the centre, and all shoots on the main branches, within one foot of the stem, should be cut out clean; this tends to strengthen the main branches, and prevents crowding when the trees grow older. Twice a year, a month before blossoming seasons, say in May and December, all cross and useless wood should be cut out, so as to let in *side light*: the crown above should not be touched, as I am inclined to think strong sun, direct upon the young blossom, is injurious. Some planters prune away all drooping branches; this no doubt improves the appearance of the trees, and, where grown under sufficient shade, I quite approve of the practice. In the open, however, they should not be touched as they serve to protect the trunk from the sun, and thus encourage the setting of blossom along it. All suckers should be *cut* away once a month, and on no account should they be pulled off.

Gathering and Curing.—The pods when ripe assume a slightly yellowish hue. They should be cut off with a knife close to the pod, leaving the stalk by which it was attached adhering to the tree. If cut off close to the branch, the eyes, on which the future blossoms depend, would be destroyed. The pods are heaped on the nearest road, and, as the husk is very brittle, a slight blow with a light wooden mallet splits it, when the seeds are extracted and put into baskets and carried to the store to be cured. This is done by laying the seeds in a heap, on a platform of reepers and coir matting, and covering it with bags or a tarpaulin. The heap is well turned every two days to ensure equal fermentation, and, on the eighth or ninth day, according to fermentation, it is washed in several waters, till quite clean and free from all mucilage. If the weather is fine, it is then spread on mats to dry; if not, it is at once put into the clerihew; three days' sun, and less I believe in the drying-houses, will dry it thoroughly, and it is then fit to despatch. Should the moisture not be dried off the beans the day they are washed, they will, during the night, contract mould, which depreciates them in value.

Permanent Buildings.—A *bungalow* should be begun and finished in the second year: the rooms should be wide and lofty and well-ventilated, with a verandah coming low down all round, and in malarious districts it should have one upstair-room as a sleeping apartment. The *store* site should be chosen on a flat, open to the sun all day, and near water. It is built on Clerihew's plan, and should have a steam-engine to work the fan; where there is water, a wheel can be employed, but in the low country few estates have sufficient for this. Opinions differ as to when the store should be ready. One gentleman says:—"I should have my store and machinery up by the time the cocoa is 3½ years old." Another says:—"I would begin to erect permanent stores at the end of the 4th year." I am inclined to agree with the latter.

Superintendence.—This in the first season is allowed for 18 months, as by far the heaviest part of his work will be in the first 6 months, from January to June; he must be on the spot, to give out and supervise felling contracts, and, immediately after the burn, which should not be later than end of February, begin nurseries, erect lines, &c. A conductor is allowed for six months; after that, till the estate begins to crop, no conductor is needed.

Yield of Crop: *Estate when in full bearing.*—I have estimated 1 cwt. per acre for the third year, 3 cwt. for the fourth, and 5 cwt. for the fifth, and they are reasonable. I have figures before me showing that over the amounts quoted have been picked. With trees planted 12 by 12 feet, 10 pods per tree yields 1 cwt., and, as there are two crops in a year, only 25 pods in each season per tree is required to give 5 cwt. per acre. I cannot ascertain when cocoa is supposed to be in full bearing; but opinions seem to point to 10 years, and a yield of 6 cwt.

Manuring.—With our poor soils, cocoa must be manured if we wish to get good crops and keep our trees in good vigor. The fifth year is not too soon to begin this. A gentleman writes me:—"I have manured some four years old cocoa with great advantage, and, when it can be done cheaply, I do not think that age too young, it put 2 cwt. an acre on my cocoa at an expenditure of Rs. 22 per acre." If results as good as this were always to follow, I should say four years old was not too young to begin.

Fencing.—This is an item I have not allowed for, but it is one that should appear in every low country estimate. A belt of sapan ten feet wide, the seeds planted 18 inches apart, will, in four years, make an impenetrable fence. At three years old the stems should *half-cut* through at three feet high and bent horizontally; thus laid, they will continue to grow and send up numbers of suckers. A fence made from sticks of the burnt-off clearing can be put up at the rate of about R2·50 per acre, which will keep out cattle, and, with a few repairs, will last 18 months. When the fence is completed, sow thickly along it on the inside seeds of the tree-cotton, and, as they grow, thin them out to 18 inches apart. In 18 months you will have a live fence that, with two rows of "varachchis" tied across at a very small expenditure, will keep out all cattle, especially if you give notice in the villages that the owners of all cattle caught in the estate *without a cross pole* round their necks will be fined heavily. I am sure from my experience of low country life that there is more ill-feeling bred between estates

managers and villagers through cattle-trespass, than from all other causes combined, and, if this could be avoided, there would be very little stealing from estates. This is my experience.

Enemies of the Cocoa Tree.—Of these, there are only two that we know at present, and neither is very serious. On individual trees scattered over the estate, the pods are seen to be spotted black, and according to the virulence of the attack the pods are either stunted in growth or killed—trees attacked one year may be quite free of it the next. Those most competent to judge say it is due to an insect. I am watching it carefully, but have not yet succeeded in discovering this insect, and I have my doubts about it; yet the way that only a tree here and there is attacked, looks very much as if it were. The other enemy I believe to be a *fungus*, though this has also to be established; it attacks the young tips of the branches, destroying them, and often the branch itself for a foot or two back. The tree, however, almost immediately throws out fresh shoots, and, in a month's time, it would not be known that anything had been wrong. I have occasionally seen a second attack follow. This disease is more common when the trees are young, and rare I believe as they grow older.

—*Ceylon Observer.*] W. J.

COFFEE.

THE DECLINE OF COFFEE.

IN the Wynaad District, we may infer, gold has had a hand in extinguishing coffee, for on those estates which have been sold to gold companies, the coffee has been entirely neglected. Cinchona, where it has been planted, may thrive, though it is liable to the depredations of similar pests as attack coffee, but, on the other hand, it does not require the annual picking, weeding, pruning, &c., that are needed for coffee. The trees will grow if left alone, but we do not hear of fresh plantings of cinchona where mining is being carried on. It is bad enough for coffee to have nearly died out in the Wynaad, but we read also that in Ceylon the same thing is going on. It appears that there the coffee planter is in a very hard way indeed. The leaf-disease first made its appearance in the island in 1870, and for some time confined its visitations to every other year, allowing an interval for the planter to pick up hope again with alternate good and bad seasons. Latterly, however, the blight has appeared every year, and has resisted all scientific attempts to expel it, and the result of four years' successive leaf-disease is that a great many planters have left the island to seek their fortunes elsewhere, not being in a position any longer to fight against a foe which it appears hopeless to overcome. Those who remain in Ceylon are turning their attention to cultivation other than coffee. Tea and cinchona are the prime favourites, though plants from which sugar and jaggery are produced and, cinnamon likewise engage attention. These, with pepper, rubber and tobacco, would, there is every reason to believe, thrive in the Wynaad. Coffee, there is reason to believe, thrives in the Wynaad. Coffee has certainly had a long trial in India, some estates being now nearly half-a century old. Time was, when colossal fortunes were reared from the bean. The diseases and pests which now decimate the trees have changed all this. Meanwhile Brazil continues to supply the market with coffee, which is a very fortunate circumstance for consumers of the beverage. Leaf-disease is still unknown there, and new coffee districts are opened up every year. Sumatra and Java already produce large crops of coffee, and in British Burmah, the Commissioner is endeavouring to make Tavoy a coffee-producing district. It is by such means as these that the supply will be kept up. It may be that, like the potato, coffee requires fresh land after a certain number of years, and perhaps in a cycle of years the time may come round when Ceylon and Wynaad will again be flourishing producers of the berry, which is now such a source of vexation and disappointment to the planters there.—*Madras Times.*

MINERALOGY.

THE PRODUCTION OF SIENA EARTHS.

CONSUL COLNAGHI, in his report on the mineral products of the province of Siena, says that Siena earths, known also under the names of ochre, bole, umber, &c, are considered by some mineralogists to be ferruginous clays: by others, minerals of iron. They are chiefly found in large quantities in the communes of Castel del Piano and Arcidosso. The yellow earths and bole found on the western slopes of Monte Amiata are true lacustrine deposits found amid the trachytic rocks, of which it is principally composed. They lie under, and are entirely covered by the vegetable soil. Varying in compactness and colour, they are termed yellow earths when of a clear ochreous tint, and *terra bolare*, or bole, when of a dark chestnut colour. Each deposit consists for the greater part of yellow earth which bole is found in strata or small veins. The mineral being very friable, excavation is easy, and is generally conducted in open pits. different qualities are separated during the process, the bole which has the higher commercial value being the more carefully [illegible] after the first separation the bole is further classed into first, second, third, and intermediate qualities—*boletta, fascia, cerchione*, &c. Its most important characteristic is termed, in commercial language, *punto di colore*, or tint. The value of the bole rises as its tint deepens. Thus, bole of the third quality is lighter than that of the second, and the second than that of the first. After the third quality comes the *terra gutilla*. The yellow earths, after excavation, are exposed to the open air for about a year, by the pit side, without classification. The bole, on the contrary, is placed in well ventilated storehouses to dry for about six months. This diversity of treatment is owing to the fact that exposure to the elements brightens the colour of yellow earths, and raises their value, while it would damage the bole by turning its darker tint first into an orange yellow, and if continued, into an ordinary yellow earth. It also loses in compactness and crumbles up under exposure. In addition to the *punto di colore*, the size of the piece influences the commercial value of the bole, which increases with their volume. Thus the classification is *Bolo pezzo, Bolo grapolino*, and *Bolo polvere*. The yellow earths are classed as *Giallo in pezzi, Giallo commune*, and *Giallo impalpabile*, the impalpable being worth more than the common yellow. The production of the Siena earths is estimated at about six hundred tons per annum of which amount about fifty tons are calcined, and the rest sold in their natural condition. The value of the trade is estimated at from £4,000 to £6,000.

THE GARDEN.

MICHAELMAS DAISIES.

ASTER (not the so-called German aster) is the scientific name of the very numerous genus commonly known as Michaelmas daisy. In form and colour they are very various, but not very distinct. They are perennials of more or less robust habit and great hardiness of constitution. Their chief value lies in their late flowering qualities. Some there are which flower early, such as *Aster alpinus* and *A. longiflorus formosus*, the former appearing in May and June, and the latter in July and August; but the great bulk of them are September, October, and, in some cases where the climate is favourable, November flowers. They are among the last of gay hardy plants to yield their flowers in the open air. And although many speak disparagingly of their leggy, ungainly habit, and of the difficulty of keeping them tidy even with much labour and trouble, yet all who know anything of them must admit that they are the most brilliant among the few hardy things we can rely upon to produce a good effect in the shrubbery border long after tender things have become seedy and unsightly. A very limited selection is all that is wanted to supply the distinctive features of the genus, and yield the best of its decorative qualities.

There are other species of hardy herbaceous plants which are coming to be called Michaelmas daisies besides asters, and although there are the best of all grounds for disputing the right of any other flower to the name (that of priority), yet there is no need for us to go out of our way to dispute that which the public has set their heart upon, for the public have decided that botanical names are a bore, and that there are sufficient points of resemblance between the members of several autumn flowering plants belonging to the same natural order, but bearing different generic names, to justify them in giving them one common, popular name, which they have decided shall be Michaelmas daisy. The aster, however, is the best of them all, because it offers a much larger number of forms and colours than any other genus.

The following is a select list of Michaelmas daisies, or true asters, which will give satisfaction in most parts of the country:—

Aster alpinus.—A neat dwarf plant, about 9 inches high. The flowers are pale purplish blue, and appear in May, lasting till July or August. There is a white-flowered variety, which makes a charming contrast to the blue; both are well adapted to the rockwork or the front lines of herbaceous borders.

Aster amellus, and its varieties named *Bessarabicus* and *Cassidicus* are attractive, the two first being the best. They are all tall forms, with lilac or slaty-blue flowers, produced in great profusion in September and October.

Aster longifolius formosus.—One of the very best of the species, having numerous large flowers of pale rosy lilac, which open in July and August.

Aster dumosus.—A tall, much-branching sort, with rather small but very numerous flowers of a slaty-blue colour; flowers in September and October.

Aster turbinellus.—A very elegant sort, with gracefully-branched stems and tall growth, and an immense profusion of flowers of pale lilac, appearing in September and October.

Aster disco or.—A freely-branched sort of moderate growth, with very numerous flower heads, with white and violet rays.

Among other distinct and useful autumn-flowering species belonging to other genera, and that are now being called Michaelmas daisies, may be mentioned the following, as very effective:—

Gillardia aristata.—This grows a foot or a foot-and-a-half high. The flower heads are large, and freely produced from July till the end of October. They are very showy, orange colour.

Helenium autumnale.—This is a striking plant which grows about three feet high, producing large spreading flower heads of bright yellow in August, September, and October.

Pyrethrum uliginosum.—One of the most showy and stately of all these so-called Michaelmas daisies It grows three, four and sometimes even five feet in height, terminating in large trusses of large pure white flower heads, resembling those of the 'ox-eye daisy.' They are produced in September and October, and in some parts of the country last till November.

Stokesia cyanea.—A very beautiful plant, wherever it may be, quite hardy, but it is not so in very cold parts. It grows about 18 inches high. The flower heads are large, deep sky blue, and appear in September and October.—*North British Agriculturist.*

SERICULTURE.

MR. JONES, in his report on the administration of the Central Provinces for the year 1882-83, describes tusser silk as "the most characteristic" of the manufactures of the province. The production of this silk is largest in the districts of Seoni, Bilaspore, Sumbulpore, and Chanda. The rearing of the worms being entirely in the hands of a low, sluggish caste, called Dhimars, no effort of the Government to stimulate the industry has proved effective. In the forest lands of the administration, where the industry is specially exempted from taxation, there is a regular system of rearing the worms which is explained in the report. The tree on which the worms are principally fed is the *saj*, *asain*, or *sn* (*terminalia tomentosa*); but they feed on other kinds of vegetation as well. No special rearing sheds are constructed, and all that the farmers do is to pollard the trees, and bend their branches so as to make them accessible to the worms from the ground. They are permitted to wander about at will; but constant watching is necessary to protect them from birds and animals. The rearing commences with the setting-in of the rainy season, and is begun with wild cocoons gathered in the jungles, and not with those saved from the last crop; and during the period occupied thus, the Dhimars, in observance of some superstitious custom, refrain from spirit-drinking and the company of the softer sex. The report then goes on to explain the process of rearing:—

The male and female moths which emerge from these cocoons are allowed to pair, and from the eggs which result, a crop of worms is raised during July and August. The cocoons which are thus produced are merely used for rearing a second crop in August and September, the produce of which is the commercial result of the venture. About 80 worms are, under favourable circumstances, reared from the eggs laid by a single female moth, and about 44 per cent of the mothers are females. Assuming therefore that a Dhimar commenced operations in June with 25 female moths, and devoted his first crop entirely to reproduction, his second crop would yield over 70,000 cocoons. It may be noted that on the emerging of the moths which result from the first crop of worms, the males fly off at once, and do not as a rule pair with the females of the same crop. The female moths remain clinging to their empty cocoons, and are fertilized by other males from the outside, who are often, it is believed, attracted from very long distances.

The ordinary tusser cocoons sell at from Rs. 3 to 5 per 1000, and are purchased directly by the weavers, who, having killed the chrysolides by steaming them, wind off the silk after the cocoons have been steeped in an alkaline solution, which acts as a solvent on the glutinous matter that binds the cocoon threads together. The value of spun tusser silk in the Central Provinces is from Rs. 6 to 10 per 2lbs., which is a higher price than the article commands in the European markets.

TUSSER SILK IN CHOTA NAGPORE.

MR. HEWITT, the Commissioner, reports:—About Rs. 89,000 worth of tusser cocoons, manufactured into silk, were exported from Hazaribagh to Moorshedabad and other places, while from Manbhoom and Singbhoom 2,500 and 10,600 kahans respectively of the cocoons were exported during the past year against the same quantity exported from Singbhoom and 7,500 kahans exported from Manbhoom in 1881-82. The Deputy Commissioners of Singbhoom and Manbhoom are both of opinion that the yield of cocoons in the past year in both districts was very large, though the Singbhoom ryots, to whom I spoke on the subject, complained of the small crop they had got; while the Deputy Commissioner of Singbhoom says that the low rate at which they were sold in the market prevented a large quantity from being exported.

I have for several years past been engaged in making enquiries about the tusser industry, which might possibly, under efficient and intelligent management, become a source of great wealth to the Division.

Tusser cocoons at present are grown either in the jungle tracts of Singbhoom and the Tributary States, or in Manbhoom and the villages in the east of the Lohardugga and Hazaribagh districts. In the jungle tracts they are grown chiefly in the jungle surrounding villages in which there is little cleared land, and the yield from these villages is yearly decreasing, as the extension of clearances moves the jungles further from the village site. More than once I have asked the people why they had given up growing tusser in these villages. They have said, "Why, sahib, when we grew tusser, the jungle was close to our houses, but now look how far off it is." As native superstition requires the tusser grower and all his family to submit to a number of ascetic observances, without which a good crop cannot be expected, the people naturally give up growing a crop which entails so much trouble and long journey to the jungles, when they can get very nearly if not quite as large profits from crops grown close to their doors without half the labour and annoyance required by the rules of tusser cultivation.

In the more cultivated villages of Singhhoom, Lohardugga, Manbhoom, and East Hazaribagh the tusser worms are fed on pollarded asun trees, some of which have been planted for the purpose, but the greater number are remnants of the jungle which once surrounded the village. The usual number of trees tended by each man is from 10 to 20. The average yield, as far as I could ascertain from enquiries made from a number of tusser cultivators in Singbhoom, is about 30 cocoons per tree, though in a good year a tree ought to yield about 100 cocoons, so that the average number of cocoons yielded by an average of 15 trees is about 450; and if the price paid be 8 annas per 80 cocoons, all that he and his family get for their watch of about a month, continued day and night, is a little more than Rs. 5-8. If this were all that could be looked for, the number of people who would go through the drudgery of watching, and the minute observances as to cleanliness and food necessary, would be very small. It is only the chance of a bumper crop of 100 cocoons or more per tree that induces cultivators to try their luck in the trade. The number who cultivate tusser is yearly decreasing and will decline very considerably in a series of years if heavy rain and wind should make the yield as bad as it was last year in Eastern Lohardugga.

On the other hand, a largely increasing demand for tusser is springing up in England, and during my stay there last year, I visited Macclesfield, and spent some days with Mr. Brocklehurst, who owns the largest silk mills in that city, and discussed the subject with him, and Mr. Wardle who superintended the preparation of the dyed silk sent by the India Office to the Paris Exhibition, is the head of a large dyeing firm at Leek, and has been for years engaged in making experiments in dyeing tusser.

From what I learnt from them, and from some correspondence I have had with Mr. Wardle, it appears that the English silk firms are prepared to take any quantity of tusser waste at at from 1*s*. to 1*s*. 6*d*. a pound, but that higher prices for unreeled silk would not now pay in England, while at anything like present rates for cocoons here this price would be utterly unremunerative. Now they can get large supplies from China at these rates, but they have no information whether these supplies will keep pace with the increasing demands of the trade, or whether the China worm which feeds on the oak-tree is domesticated or feeds in the jungles. In the latter case the supply is not likely to be largely increased, and a rise in prices, if the demand still continues, may, if the work of production could be reduced, make the export of Indian tusser waste pay.

The China tusser silk is naturally white, and does not require bleaching, whereas it is a very difficult matter to bleach the Indian tusser. The latter is, therefore, much more expensive than the Chinese for all white silks, and can only compete with it at present prices in dyed goods and those of its natural colour; but Mr. Wardle writes to me on the 10th March this year—"I should be much delighted if Indian tusser could replace Chinese; I find it is preferred by the spinners." But except when used as waste, he says—"It must be reeled where labour is cheap," as it will not pay for reeling in England.

The price of reeled China tusser given by him in the letter above quoted is from 5*s*. to 5*s*. 6*d*. per pound; but to make a pound of silk according to Major Cousmaker's experiments requires an average of 436 cocoons; and though the cocoons of Chota Nagpore are larger than those of Bombay, where Major Cousmaker's experiments were made, yet, as far as I learn from enquiries among the natives, his estimate must be considered to represent very fairly the outturn from cocoons in this country. At the rate of eight annas for eighty cocoons, the cost of obtaining a pound of silk would be more than Rs. 2-8, or about the price of the best reeled China silk at home without the cost of reeling. Therefore, before even reeled tusser can pay exporters well, the price at home must be increased, or the cost of production must be materially reduced. Feeding tusser worms on asun trees will never pay, as the trees cover a large space, and the yield of the number of trees which one or one family can look after is very small; but if ryots could be induced to plant hedges of *Lagerstrœmia Indica* (a shrub on which Major Cousmaker successfully reared cocoons in Bombay) in the gardens close to their houses as they now plant opium and vegetables, the yield of cocoons could be very largely increased. On an acre of wide spreading asun trees only about 440 trees, yielding an average crop of about 13,000 cocoons, could be grown; whereas Major Cousmaker has reared an average of 20,205 cocoons to the acre on *Lagerstrœmia*, and probably more could be reared on hedges close to a ryot's house, and constantly looked after by himself and his family. But of course the ryots will not do this without the hopes of a large profit, and they must, therefore, be able to get from the small patches of *Lagerstrœmia* they can plant in their gardens more than they now get from the few asun trees they can look after. If a man now gets an average only of about Rs. 5-8 and the industry is declining, it will require at least an average receipt of Rs. 8 to make the cultivation [illegible] popular; while, if it could be increased to Rs. 10, the number of tusser cultivators would be very largely increased, but only if a family can look after about an acre of hedge planted about two feet apart, and it is only by experiment that an area a family can look after can be ascertained. In order to make a profit on reeled silk at present prices, it would, considering the expenses of setting up and maintaining filatures with reeling machines, added to those of supervision and transport, be necessary to be able to buy the cocoons at not more than 2*s*. or Re. 1 for the quantity required to make a pound of silk. This would be about in round numbers 440 cocoons or 110 for 4 annas—a price much less than that now given; but if, on the other hand, the average yield could be raised to 20,000 cocoons an acre by substituting *Lagerstrœmia* hedges for asun trees, a ryot could on one-fifth of an acre procure cocoons which he would sell for nearly Rs. 10 [illegible] the filature.

Here, however, another question would arise—could a ryot and his family look after more than one-fifth of an acre?—and if they could not, I very much doubt whether the prospect of getting only Rs. 10 would be held by the more enterprising ryots, such as Kooiries and Koormis, who would alone undertake the cultivation of a *Lagerstrœmia* plot, to be sufficient to compensate

them for their trouble, especially as the cocoons must be brought to the filature before this price could be got. I am afraid this would detract greatly from the attractions which the receipt of Rs. 50 for the crop grown on an acre would present if tusser only required the care requisite for ordinary crops. Therefore, even supposing that a pioneer of the trade did appear possessed of the very sure qualities necessary to overcome prejudices of the ryots, the capital necessary to make a profit after many failures, and a patience not easily discouraged, the success of his endeavours would be doubtful; but if he did succeed, I believe that, owing to the increasing demand for tusser, he would make a large fortune provided the facilities for increasing production in China are not greater than those in India; and as one successful experimentalist would find his example followed by many others, the wealth of the country would be enormously increased by a large and prosperous trade, which would, owing to the cheapness and abundance of labour which the country will probably always furnish, and the probable absence of competition from other countries if Chinese tusser is once beaten out of the market, be likely to be permanent.—*Calcutta Gazette.*

TEA.

COLONEL MONEY ON TEA MANUFACTURE, AND MACHINERY.

THE preface to the first edition of Col. Money's Prize Essay on Tea Cultivation was dated November 1870, and stated that the Essay embodied the results of eleven years' previous experience. The fourth edition, published in July this year, contains, therefore, the mature conclusions of a full quarter of a century of experience of the cultivation and manufacture of tea, in such widely separated and differing portions of India as Darjeeling, Chittagong, the Nilgiris, and the Dooars. Had Col. Money paid a visit to Ceylon before this latest edition of his work was issued (and it is strange he did not, considering the ties which bind him to this island), he would have received information and seen for himself a state of things which might have led him to reverse some of his opinions, and deal more fully than he has done with one of the youngest but not the least promising of the tea countries of the world. When Col. Money commenced his career as a tea planter, the idea that Ceylon, already the third coffee country in the world, should threaten even the supremacy of Darjeeling, Assam, and Cachar as a producer of tea, would have seemed as preposterous as the assertion, that ere long tea would be rolled, fired, and largely sifted by machinery, and without the use of charcoal as a fuel. To Col. Money Indian tea planters are largely indebted for the simplification of the manufacturing processes, and the discovery that the copper pans which the Chinese had used for many centuries, and to which they still adhere as tenaciously as they do to ancestral traditions generally, are in reality superfluous. But time and experience were necessary to convince him and other early planters, that hand-rolling could be completely superseded by machinery, and that the detergent fumes as well as the clear, intense heat of charcoal was not necessary to the outturn of the best tea. Writing of the final firing before packing, Col. Money states:—

"Though I know many planters think the fumes of charcoal necessary and beneficial for the last drying, I do not. I have tried both sun and charcoal, and no difference was perceptible. The former costs nothing, is more commodious, and I always apply it when possible. The sun cannot burn the teas; the charcoal, if the heat is too great, may.

"Whether you use sun or charcoal, put the tea hot into the boxes. The only object of the final drying is to drive off the moisture, which the tea will certainly, in a more or less degree, have imbibed since its manufacture. Even the large zinc-lined bins, which should be fitted up in all tea stores, and in which the tea is placed after manufacture, will not prevent entirely damp, so in all cases a final drying is necessary."

We believe that few tea manufacturers now resort to sun, except, excepting perhaps the makers of green tea in the north-west Himalayan districts. We should like to know, however, the extent to which, if at all, sun-heat is utilized by tea manufacturers in Ceylon. Col. Money states:—

"Sunning between the fermenting and firing processes has no effect whatever on the liquor or the out-turn, but it makes the tea rather blacker, as it drives off much of the moisture in the roll, the firing process after it is shorter and does not consume so much charcoal. What little effect therefore it has is good (for if not continued too long, it does not make the tea too black) and it is economical. I therefore decided on retaining it.

"At the end of the season, however, sunning has more than the above effect. It then makes the tea 'chubby' in form, of a reddish colour, and improves the strength of the liquor."

Col. Money, in the new edition of his book, after "Manufacture," and "Mechanical Contrivances." He leans to excess rather than deficiency in withering process; and as to rolling, the result of his experience is that "in all but the point of pekoe tips, hand-rolling is better." No doubt the thorough breaking up of the leaf cells brings out the strength of the tea, provided the juices be re-absorbed and the process of "fermentation" well-performed so as to avoid equally "rasping" pungency and "fusionless" liquor. Col. Money, adhering to the Indian tradition of a good tea for mixing purposes, still retains the following paragraph:—

"*The Liquor.*—In taste this should be strong, rasping, and pungent, with, in the case of Pekoes, a 'Pekoe flavour.' There are other words used in the trade to particularise certain tastes, but the words themselves would teach nothing. Tea tasting cannot be learnt from books. *If* the liquor is well flavoured, as a rule, the darker it is in the cup the better. But to judge of teas by the colour of the liquor alone is impossible, for some high class teas have naturally a very pale liquor."

In India largely, in Ceylon wholly, teas are now made to be used on their own merits and not as fortifiers of weak China stuff. We do not suppose that the table described in the following paragraph has yet reached Ceylon:—

"An ingenious planter, a Mr. McMeekin, in Cachar, invented a rolling table with the object of separating the said leaves. It is constructed of battens, and while rolling the leaf on it, many of the small leaves fall through. The said table is now well known in Cachar, and is in use in several gardens. I have tried it, and find that in a great measure answers its object, but the objection to it is that the leaf *must* be rolled lightly, and lightly-rolled leaf, as observed, does not make strong tea.

"The Pekoe tips may be, in a great measure, preserved by rolling *all* the leaf lightly on a common table. But then again the tea is weak, and the plan will not give so many Pekoe tips as McMeekin's table.

"In short, in the present state of our knowledge, except by the hand process (a tedious and expensive one for separating the leaf), strong teas and Pekoe tips are incompatible.

"The difficulty is just where it was, and will so remain until dealers give up asking for Pekoe tips (not a likely thing), or till a machine is invented to separate quickly and cheaply the two said small leaves from the others *after* they have been all picked together. That such a machine is possible I am certain, and the inventor would confer a boon on the tea interest far beyond the inventor of any other machine, for all the other processes can be done by hand without much expense: this cannot."

Col. Money then goes on to notice such machines and contrivances as he knows of for cheapening the manufacture of tea. Kinmond's rolling-machine he originally considered the best, although he did not believe in any machine entirely superseding hand-rolling until he had seen Jackson's which finishes the rolling. The different conditions in India and Ceylon are strikingly apparent in the fact that Col. Money, while speaking of manual, animal, wind and steam power applied to machinery, does not mention waters which is available for the vast majority of our Ceylon tea estates. Col. Money mentions, without having seen it, a rolling-machine invented by a Mr. Gibbon, and a good deal used in Cachar. Col. Money wrote:—

"I only know of one other tea rolling-machine, which is Nelson's. It does not profess to do more than *prepare* the green leaf for rolling, which, as stated above, is, I think, all that any machine will ever do. I have never seen it working, but it appears simple, being nothing more than a mangle. The leaf is placed in bags, and then compressed under rollers attached to a box, weighted with stones. The prospectus states, it will prepare 80lb. green leaf in fifteen minutes, and that one man can then finish as much of such prepared leaf in three minutes as would occupy him twelve minutes if the same had not been prepared. I see nothing unlikely in this. The machine, though inferior to Kinmond's in its arrangement, *ough* to be cheap enough to bring it within the reach of all."

"Unfortunately it is not. It is advertised at R300, with a yearly royalty of R30 the first year, and 20 after. The royalty should be dropped, and the machine sold for R150, which would give the inventor a good profit."

We quote again:—

"I have already spoken of one of McMeekin's inventions. His chest-of-drawers for firing tea is, I think, superior to his batten table. It is now so well known, and in such general use, that I shall describe it very shortly. It is nothing more than a low chest-of-drawers, or trays fitted in a frame one above the other, the bottom of each tray being fine iron wire, so that the heat of the charcoal, in the masonry receptacle over which it is placed, ascends through all the drawers and thus dries or fires a large quantity of 'roll' at the same time. By the old plan, a single wicker sieve was inserted inside a bamboo frame called a 'dhole' which was placed over a charcoal fire made in a hole in the ground. On the sieve the roll was placed, and all the heat, after passing through this *one* sieve, was wasted. Mr. McMeekin's idea was to economise this heat by passing it through several drawers.

"Most planters use these drawers, and there is no doubt in the space saved, and the economy of heat: it is a great step in advance over the old barbarous method, where not only was the heat wasted after passing through *one* sieve, but a great deal was lost through the basket-work of the 'dhole' itself.

"Still I do not advocate four, still less five drawers one above the other. I think the stream ascending from the lower drawers must, more or less, injure the roll in the upper ones. I confine myself to two, and even then in the top tray leave a small circular space vacant by which the steam from the lower drawer can escape. I utilize the heat that escapes, partially, by placing 'dhallas' in tiers above, with roll in them. These are supported by iron rods let into the wall, and are useful not only for partly drying the roll, but also for withering leaf when there is no sun."

It would thus appear that Mr. McMeekin had anticipated the main principles of the sirocco and driers now in use. Col.

Money finally noticed an advertisement respecting Jackson's sifting machine, and said its larger size than those previously in use might be in its favour. A machine for sifting and fanning tea at the same time, Col. Money had used, but it did not sort the teas with any nicety, and, although it fanned the tea well, that process might be done by much cheaper appliances. A Jackson's sifter is doing very good work on Abottsford. Space and light, Col. Money truly says, are the great wants for withering leaf in wet weather. Col. Money believed in tea-houses made of iron and glass, and, when the third edition of his book was passing through the press he was sending out glass for a tea-house. He has not, in the fourth edition, related the result, but we can have no doubt it was good. Colonel Money correctly states :—

"One and the principal reason why Indian Tea is stronger than Chinese is that in India the sap or juice is generally retained, while in China it is, strange to say, purposely wasted!"

But Mr. Sillar in England, Mr. Everard in Melbourne, and others whose interests were specially wrapped up in China tea, indulged in the most vehement and senseless denunciations of Indian tea, as awfully unwholesome, just because the juice containing the strength of the tea was not thrown away! After describing the various operations in tea manufacture, Colonel Money wrote :—

"All the above operations should be carefully conducted, but I believe the secret of good Tea consists simply in—*first*, stopping the fermentation at the right moment; and, *second*, in commencing to drive off the moisture immediately after."

"In this article we have dealt only with Col. Money's incidental allusions to tea machinery in his chapter on the "Cultivation and Manufacture of Tea," but in the fourth edition there is a chapter of no fewer than 47 pages devoted to "Tea Machinery," to which we shall advert in a further article. Meantime, we may say that Col. Money pronounces as strongly in favour of Kinmond's drier, as he previously did for Jackson's roller. Kinmond's drier we have not seen, but our experience of Jackson's is very favourable, although we are not yet able to say what the consumption of fuel in the proportion to work done is, as compared with Davidson's sirocco and Kinmond's drier.—*Ceylon Observer.*

TOBACCO.

NOTES ON TOBACCO CULTURE IN THE ANAND, PITLAD AND BORSAD TALUKAS OF THE KHAIRA COLLECTORATE, GUZERAT.

TOBACCO is planted in the "Gorarukuvetar" lands, which must be well manured to receive it. The land must be ploughed 8, 10, or 12 times and one bigha* requires 20, 25, or 30 cart-loads of manure. The more manure is applied, and the more the land is stirred by the plough, the more plentiful will be the crop, and better the tobacco. In one bigha about 8,000 plants are set, when the tobacco is out, a few of the stalks are left standing, and these send out shoots, which flower and produce the seed. But it is not necessary to water these stalks or to take any trouble about them, and usually only about 20 are left for seed in each bigha. This seed is sown after the first fall of rain in July, on a small piece of ground, well ploughed and manured to receive it, and made up into little beds like garden ground; and if rain does not fall in due time, it must be watered. The young plants are ready to be transplanted into the fields in a month, or a month and half. If they are good and plentiful, one bigha of them will serve to plant 40 bighas, or if inferior 20 bighas; when these plants are sold by one cultivator to another, they bring Rs. 1, 2 and sometimes 3 according to their demand for as many as will suffice for one bigha of land. When the land is quite pulverized, and ready to receive the plants, a large rake (jesli) having 3 or 4 teeth at a distance of 1 *hath* and 3 *tasus* (nearly two feet) from each other, is dragged over the field lengthways and crossways, so as to divide it into squares and wherever these lines intersect each other, there the plants are set in. This instrument also ensures to eradicate weeds out of the soil. The planting takes place during the intervals of fair weather within the last fifteen days of August, and the first fifteen days of September, and it requires the land to be moist. If no rain falls for a month or so furrows must be made with the plough, and water let into them. The young plants, when set, must be watered two or three times, and if the sun be powerful, must be shaded until they take root. Should rain fall every 15 or 20 days afterwards water is not required, but if a whole month intervenes without a shower, the tobacco must be irrigated. After the monsoon, it requires watering every 10 or 12 days, and if the water be a little salt, it is preferable to the perfectly sweet water. There are four kinds of tobacco, "Talapdi" "Khandeshi," "Ilaichi," and "Gandia," but only two of these are produced here, namely, "Talapdi" "and" "Khandeshi," of which the "Khandeshi" has a large thick leaf, and that of the "Talapdi," thin and small. The best and worst sorts of tobacco are not the produce of particular fields, but depend on the labour, care, and skill of the cultivator, and in some degree, on the quality of the water. The "Khandeshi" tobacco also weighs more than the "Talapdi." The tobacco takes 5 and 5½ months to ripen. It is particularly liable to two misfortunes, one of these is the "him" or frost in the "shialu" or cold season, and the other is the rain which sometimes falls about the "holi" when it is cut and lying out in the fields to dry. The tobacco is cut during the last 15 days of February and during the first 15 days of March. After the "Divali" and end of October, it is necessary to go through the fields from time to time to cut out the sprouts which the plant throws out for flowers, as unless these are removed, the leaves lose the sap necessary to give them their proper flavour. When the tobacco is ripe, it is classed into "kalia" and "gardo." That which is thought good enough for "kalia" is cut down stalks and all, and placed in the field in rows to dry. It remains thus 10 or 12 days, and is then tied up in the early morning, while moist with dew, and carried home and made up there into bundles, with as much expedition as possible; it is the labour of 5 or 6 days to tie up the produce of one bigha, and that of 10 days more to have the bundles, properly turned, dried, and made fit for sale. If the sale does not take place by this time, the bundles are turned every 7 or 8 days till they are disposed. It is an object to sell tobacco, as soon as possible, as it loses weight by keeping, and requires much looking after. The leaves of the plants that are looked upon as "jardo" are removed from the stalks with the bark, and allowed to dry on the ground for 12 or 15 days upside down, and are, then, brought home little by little. The large leaves are then separated from the smaller ones, and the whole is made up into bundles, having layers of large and small leaves alternately. The "kalia" tobacco is used for the "hooka" and for snuff. The "jardo" is used for chewing and for "biris." The tobacco grown here is considered to be the finest, and a sample cured under European agency and forwarded to England fetched a higher price than the American tobacco, but the process of curing is not known, and hence the tobacco as made ready for sale by the cultivators and forwarded, to England did not even pay its own freight. I shall therefore feel obliged by you or any of your readers giving the entire method of curing tobacco as practised in America or at Manilla, so as to enable the growers here to compete in the market of London.

V. S. VYAVAHARKAR.

* One bigha is equal to 25,600 square feet or a square of 160' by 160'.

INDIAN CHEROOTS.

INDIA supplies herself with cheroots as well as with tea, but no one will venture to say that her cheroots are at all equal to her tea, though the latter is just as much a manufactured article as the former, and much more difficult to produce in approved merchantable form. The tea industry is much more recent in this country than the cheroot industry, and we would naturally expect to be able to get better cheroots than tea. But the fact is otherwise. And strangely enough, while the price of teas of every quality is being lowered, the price of cheroots is steadily increasing. Again, while the quality of all teas is improving, the quality of all cheroots is, if not degenerating, certainly not improving. The only conclusion we can come to from these facts is, that the tea industry is in the hands of a more intelligent class than the cheroot industry. The cheroot-manufacturer seems to understand how to fix the price of his produce on the political economy law of supply and demand, but he fails to appreciate the pecuniary advantages to be derived from an improved quality of production. In this respect he appears to be in the last degree conservative, and to take for the rule of his life the motto, "As it was in the beginning, is now, and ever shall be;" and so the quality of the Indian cheroots of 1883 is no better than those of 1833. While Manilla competed with India in cheroots of the higher qualities, it was not to be expected that the manufacture of cheroots in this country would improve very much, if at all. Up to the middle of the present century, and for ten or fifteen years thereafter, Manilla supplied the Indian market to a considerable extent with cheroots of the higher qualities, and Southern India, of which Trichinopoly was the chief manufacturing town, was content to supply the cheaper and lower quality of article. The price of the best quality of the Manilla manufacture was about six times greater than that of the Trichinopoly manufacture. This being the case, it seemed hopeless to expect any part of Southern India, Lower Bengal, or even Trichinopoly itself to make an attempt to compete with Manilla. It was said that the best quality of Indian tobacco was far inferior to the medium quality of the best Manilla tobacco, and that the best quality of Manilla tobacco could not be grown in India at all. Under this view of the industry we can well understand why no efforts were made to improve the best qualities of Indian tobacco. But for the last fifteen or twenty years the Manilla cheroot supply has been lost to India, and the quality of the present importations from that country are probably inferior to that of the best Indian cheroots. Practically, the Manilla supply has gone, and the Indian cheroot manufacturer has virtually a monopoly of the trade in this country. But as we have said, he has done nothing to improve the manufacture, while he has advanced the price of his produce at least 100 per cent. At first sight, this condition of a rapidly-growing and a well-paying industry appears difficult to understand. It seems either that

the whole class of cheroot manufacturers in this country are incapable of discerning their own pecuniary interests, or that it is impossible to improve the quality of the Indian tobacco or quality of the cheroot offered for sale in the Indian markets. When we consider the variety of climate and the various qualities of the soil in this country, there appears to be no good reason why the best qualities of tobacco at least cannot be improved. The qualities of tea, coffee, cotton and wheat have been vastly improved, and tobacco, we think, is capable of some, if not of equal, improvement. Tea growing and manufacture have been studied in China by Indian planters; why should not tobacco planters and cheroot manufacturers go and study the growth of tobacco and the manufacture of cheroots in Manilla? The result would pay, we feel assured. Whatever may be the difficulties in the way of improving the quality of the cheroots supplied by India to her own markets, if there are any real difficulties at all, the fact stands out clearly and lamentably that the Indian cheroot manufacture is not a thriving, but probably a declining, industry—certainly for the higher qualities. It may be said that the manufacturer is quite satisfied so long as he can sell the whole of his produce at a paying rate, and that he has no inducement to improve the manufacture. This view is both commercially unsound and dangerous, and is calculated to raise competition once more from without, or to make the consumer seek tobacco of other qualities, such as are used in the cigarette and the pipe.

Apart from the question of improving the present quality of Indian tobacco, there is sufficient cause of complaint in regard to Indian cheroots as now manufactured. The chief object which the manufacturer seeks to accomplish is apparently to produce quantity, especially in the high-priced cheroots. Thus we find ourselves provided with cheroots of inconvenient length and thickness, dimensions such as smokers do not want. These dimensions are wrought out by the unpardonable sin of packing the interior of the cheroot with tobacco stalks. This packing with stalks should be made a felony at the least, and be punishable under the Penal Code. The smoker does not want the stalks in his cheroot; nay, he totally objects to them, inasmuch as they destroy the flavour of the tobacco and cause many a cheroot, which might otherwise be smoked, to be thrown away unconsumed. If stuffing cheroots with tobacco stalks is little less than a swindle, what shall be said for the other vexatious proceeding of the manufacturer, *viz.*, that of mixing tobaccos of various qualities in one cheroot, and cheroots made of different qualities of tobacco in the same box? This diversity of produce is a sore evil. The purchaser is first deluded in the purchase of his cheroots, and afterwards disappointed when using them. It is the wide experience of the users of Indian cheroots that the qualities even of the best and most highly-priced cheroots are seldom or never similar. Various qualities are to be found even in small boxes of 100 and in bundles of 25, while it is difficult to procure the same quality of tobacco twice over when similar boxes are purchased from the same dealer. How often is the smoker constrained to throw away about half-a-box of cheroots because of the difference in the quality of the tobacco. This waste doubles the price of the cheroot to the consumer. Years go on, and these villainous practices of packing cheroots with tobacco stalks, of mixing tobaccos of different qualities in single cheroots, of packing cheroots manufactured of different qualities of tobacco in the same box, and supplying cheroots of different qualities of tobacco under the same name and brand, continue with unabating regularity, causing the user to believe that the manufacturer does not distress himself in the least about the claims of conscience. The user of the Indian cheroot, who pays Rs. 25 per 1,000 for his purchase, really expends Rs. 50 per 1,000 in the article, because of the variety in the cheroots he buys. It was never so with the higher brands of Manilla cheroots, for all were equal in quality, and none were thrown away unconsumed. For many years some of the long established Bombay European firms imported the higher-priced cheroots from Manilla for their friends. The quality was always good, and the price fair. Subsequently John Treacher engaged in the business, and the supply was always reliable and satisfactory. The price for No. 1 cheroots ranged from Rs. 80 to Rs. 100 per 1,000, which may be considered high in comparison to the price of "trichys" and other similar manufactures, but the Manillas were always of equal quality, and practically the purchaser of 1,000 obtained that number of useable cheroots. The manufacturer supplied what the mark on the box declared the contents to be, and the purchaser was never disappointed. Now that there is no hope of a supply of the quality of cheroots from Manilla, the Indian manufacturer should wake up to his own interest, and improve his produce in the way we have indicated. The public have borne the existing imposition long and patiently enough; it is now time we should have a little reform. Bombay has a large number of cheroot dealers; many of these dealers seem to be able to secure a living by dealing in cheroots alone. Surely, some of these dealers can influence the manufacturer sufficiently to put a stop to the unreasonable practices which check the growth of what ought to be a great Indian manufacture. Let the Indian cheroot manufacture be brought up to the improving level of the tea manufacture, and the public will be satisfied. It is sad to see a thriving industry degenerating in the days of its prosperity, at the risk of commercial suicide.—*Bombay Gazette.*